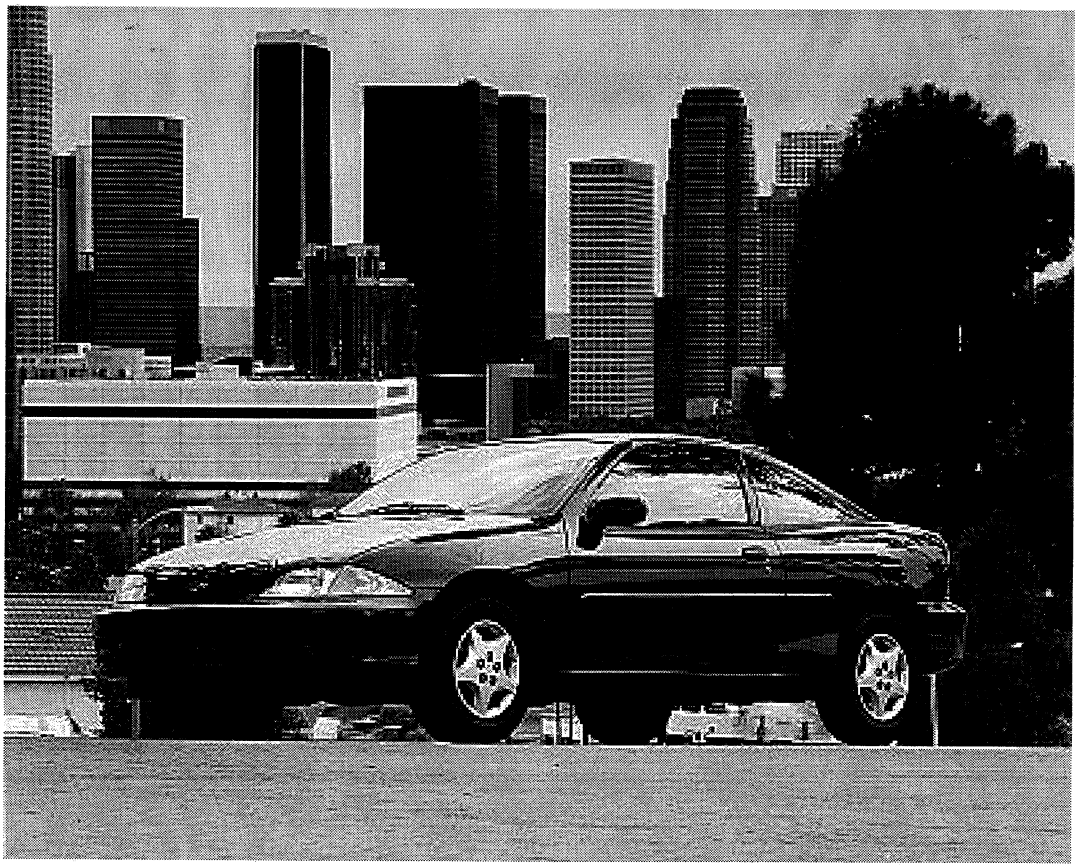
Chevrolet

Cavalier



2001

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Product Information

Top-Selling Chevrolet Cavalier Still A Leader In 2001

DETROIT — The Chevrolet Cavalier is General Motor's best-selling passenger car and one of the ten best-selling cars in the United States. With refinements such as a premium amplified audio system and a new color added to Cavalier's already impressive list of standard equipment, Cavalier is poised for another successful year in 2001."Cavalier has been very successful in attracting young buyers to Chevrolet, due to its standard equipment that even includes four-wheel antilock brakes," says Steve Wagg, Cavalier brand manager.

Cavalier Model Lineup

For 2001 the Cavalier lineup will include four models: Cavalier Coupe, Cavalier Sedan, Cavalier LS Sedan and Cavalier Z24 Coupe.

Cavalier Powertrains

Cavalier Coupe, Sedan and LS Sedan all come equipped with a proven, efficient and low- maintenance 115-hp 2200 L4 engine with sequential fuel-injection. Optional on the LS sedan, but standard on Z24 Coupe, is a 2.4L Twin Cam L4 engine that cranks out 150-hp and 155 lb.-ft. of torque for spirited performance and impressive fuel economy.

All Cavaliers, with the exception of the LS sedan, come equipped with an efficient 5-speed manual Getrag transmission that is engineered to make shifting smooth and easy. A 4-speed electronically controlled automatic transmission is standard on the LS Sedan, optional on other Cavalier models. This lightweight but durable automatic comes with long-life automatic transmission fluid. Included with the automatic is traction control, a feature not even offered on many cars in the Cavalier's price range, for added stability when accelerating on slippery roads.

Cavalier Standard Features

One of the reasons Cavalier is so successful is its high level of standard equipment at a reasonable price. Standard safety and security features include: dual front air bags, brake-transmission interlock on automatic-equipped cars, Daytime Running Lamps and a PASSlock™ theft-deterrent system. All Cavalier buyers enjoy standard features such as air conditioning, electric rear window defogger, front bucket seats, a full-folding rear seat and intermittent windshield wipers.

Moving up to the LS sedan and Z24 Coupe, standard features also include cruise control, power door locks, tilt-steering column, body-side moldings and an upgraded AM/FM stereo radio with CD player and TheftLock anti-theft system.

New for 2001, Indigo Blue Metallic is added to the exterior paint palette, while a CD radio is now included on Base models when the optional Preferred Equipment Group 1SB is ordered. The V1I Sport Package on the base coupe now includes the new 6-speaker premium amplified audio system with rear-woofer speakers, rear spoiler and tachometer.

Cavalier Brakes And Suspension

Another standard feature that sets Cavalier apart is front disc/rear drum brakes with four-wheel antilock brakes (ABS). Standard ABS on all models adds to Cavalier's value because other competitors in this price range don't offer ABS as a standard feature on all models. It's either an extra cost option or available only on higher-cost trim levels.

The standard suspension includes MacPherson strut front and trailing twist-beam rear with coil-over-shock corners that help provide a smooth ride and excellent driver control.

Cavalier Z24 Coupe boasts a more aggressive suspension befitting its sportier demeanor. The Z24 has shaped inner-metal bushings on front lower control arms, higher-rate front and rear springs, stiffer shocks and struts, and a larger front stabilizer bar. This combination helps provide a firm ride, yet sportier feel and better handling than the base suspension design.

Cavalier Wheels And Tires

Base Cavalier models feature 14-inch wheels and all-season tires to handle a variety of road demands. The LS Sedan comes with larger 15-inch wheels and all-season touring tires for an even smoother ride. Full wheel covers are provided on all. In keeping with the sporting nature of the Z24 Coupe, 16-inch aluminum wheels with more aggressive P205/55R performance tires are standard.

Special Cavalier Bi-Fuel Package

A special bi-fuel version of the Cavalier is available for both fleet and retail sales. It meets all federal safety standards and Transitional Low Emission Vehicle (TLEV) standards in all 50 states. The Bi-Fuel Cavalier Sedan uses the 2200 L4 engine and automatic transmission, but runs on gasoline and compressed natural gas (CNG). Its fueling system uses the CNG first, for an estimated 160 miles, then automatically switches over to gasoline, if necessary, for roughly 400 more miles. To accommodate the added weight of its fuel system, this Cavalier has an upgraded suspension system. Like all Cavaliers, it is backed by GM's 3-year/36,000-mile No-Deductible Limited Warranty and can be serviced at authorized GM dealers and facilities throughout the United States.

Brand Identity

The Chevy Cavalier is a smart buy. Look again and see it as one of the great values in its class.* In addition, Cavalier has an impressive safety package which includes Daytime Running Lamps (DRLs) and a PASSlock® theft-deterrent system.

* Based on 2000 competitive information and GM segmentation. Excludes other GM vehicles.

New for 2001

Interior

- CD player is now included in PEG 1SB on Base Coupe and Sedan and standard on LS Sedan and Z24 Coupe
- 6-speaker Premium Amplified Audio System with rear-woofer speakers is optional with the UIC CD radio and standard with the UPO uplevel CD and cassette dual playback radio

Exterior

- Indigo Blue is a new color
- V1I Sport Package now includes the rear spoiler, tachometer and Premium Amplified Audio System

Vehicle Overview

Models

- Cavalier Coupe
- Cavalier Sedan
- Cavalier LS Sedan
- Cavalier Z24 Coupe

Special/Fleet Packages

Bi-Fuel Cavalier Sedan (interim availability)

Gasoline and compressed natural gas (CNG) power the Bi-Fuel Cavalier Sedan which was introduced in 1998. Its fueling system uses the CNG first for an estimated 160 miles and then automatically switches to gasoline, if necessary, for about 400 miles.* Using a patented Hyperfill device, the CNG system includes a fuel tank which holds 6.9 gallons gasoline-equivalent @ 3600 psi. This system has undergone extensive testing and meets federal safety standards and Transitional Low Emission Vehicle (TLEV) standards in all 50 states. Available for fleet owners and retail sale, the Bi-Fuel Cavalier Sedan is backed by the GM 3-year/36,000-mile† New Vehicle Limited Warranty and can be serviced at authorized GM dealers and facilities throughout the United States. To accommodate the added weight of its fuel system, this Cavalier has an upgraded suspension system. The Bi-Fuel Cavalier has many of the same standard items as other Cavalier models, including:

- 2200 L4 engine
- Automatic transmission
- Driver and front-passenger air bags**
- Power steering
- 4-wheel antilock brake system
- Stainless-steel exhaust system

* Individual mileage may vary.

† Whichever comes first.

** Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.

Customer Profile

Cavalier remains one of the top new-car choices for first-time buyers*. With many standard features, it offers value to the small-car buyer. It's the kind of car for young-minded people with purchasing savvy who want a more attractive, quality small vehicle reflecting their sensibility.

* Based on General Motors TCE Buyer Behavior Study – 1999 model year.

Coupe and Sedan Buyer Demographics

- Median age: 18–24 Years
- Median household income: $50,000
- Purchaser (male/female): 35%/65%
- Married: 25%
- College graduates: 40%

Competition

- Ford Focus
- Dodge Neon
- Honda Civic

Color and Trim

Exterior Colors

- Dark Colorado Green Metallic
- Ultra Silver Metallic
- Sandrift Metallic*
- Bright White
- Black
- Indigo Blue Metallic
- Bright Red
- Cayenne Red Metallic

* Not available on Z24 Coupe.

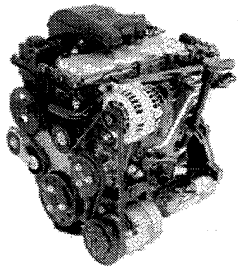
Interior Colors

- Graphite (includes Red inserts for Z24 models and Teal inserts for LS)
- Neutral
- Medium Gray (LS and Z24 models)

Engines

2200 L4 SFI and 2.4 Liter Twin Cam L4 Engines

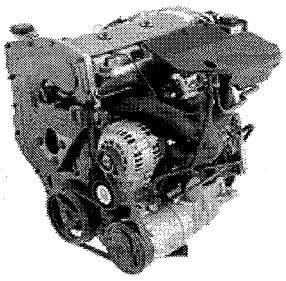
Technical Features of the 2200 L4 Engine:



- Valvetrain roller rocker arms use roller bearings to reduce friction
- Hydraulic roller valve lifters
- "Assembled" steel camshaft
- Induction system features two resonators and a large-volume air cleaner for quiet operation
- Sequential Fuel Injection (SFI)
- Cast-aluminum cylinder head
- Torque axis powertrain mount system
- Exhaust Gas Recirculation (EGR) system
- Low-maintenance features, including platinum-tip spark plugs and extended-life engine coolant.*

* Maintenance needs vary with different uses and driving conditions. See the Owner's Manual for more information.

Technical Features of the 2.4 Liter Twin Cam Engine:

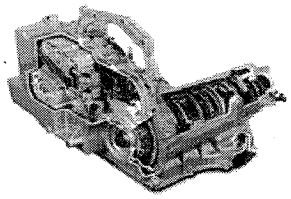


- Dual overhead camshafts
- Cast-aluminum cylinder head
- Composite intake manifold
- Sequential Fuel Injection (SFI)
- Exhaust Gas Recirculation (EGR)
- "In-oil-pan" design balance shaft system
- Torque axis powertrain mount system
- Stainless-steel fuel injectors
- Direct-drive power steering pump
- Low-maintenance features, including platinum-tip spark plugs and extended-life engine coolant.*

* Maintenance needs vary with different uses and driving conditions. See the Owner's Manual for more information.

Transmissions

4T40-E 4-Speed Electronic Automatic Transmission



The 4T40-E is standard on LS Sedan and optional on all other models.

Technical Features of the 4T40-E Transmission:

- Fully integrated and synchronized Powertrain Control Module (PCM)
- 4T40-E is lightweight, contributing to overall fuel efficiency
- Chain-transfer two-axis configuration
- Special lightweight composite materials
- Long-life automatic transmission fluid*
- Traction Control is standard with the 4T40-E

* Maintenance needs vary with different uses and driving conditions. See the Owner's Manual for more information.

5-Speed Manual Transmission

A Getrag 5-speed manual transmission is standard on all Cavalier models except the LS Sedan.

The 5-speed manual transmission and clutch are engineered to make shifting smooth and easy:

- Clutch pedal has a short, efficient travel
- Concentric slave cylinder provides a solid pedal feel and smooth clutch operation

Suspension

Front Suspension

- MacPherson strut front suspension with coil spring
- "Progressive-ride" system helps allow precise tuning between the chassis and suspension system
- Level II Sport Suspension, on Z24, includes shaped inner-metal bushings on front lower control arms, high rate front and rear springs, and a large stabilizer bar
- Accurate wheel alignment is provided at all four wheels by using precision equipment during the manufacturing process. Throughout the vehicle-build process, measurements are taken to help provide that components affecting final wheel alignments are correct
- 19mm link-style stabilizer bar for Coupe and Sedan models with LD9 engine
- 22mm link-style stabilizer bar for Z24

Rear Suspension

- Training tubular control arms with twist-beam axle
- "Coil-Over-Shock" design
- 18mm solid stabilizer bar for Z24

Steering

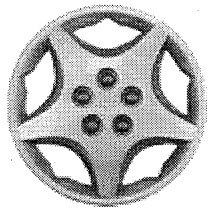
- Power rack-and-pinion for all models
- Steering rack mounted on the front suspension cradle

Brakes

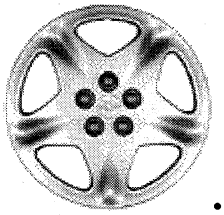
- Power-assisted front disc and rear drum
- Four-wheel ABS

Wheels and Tires

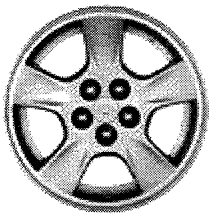
Wheels



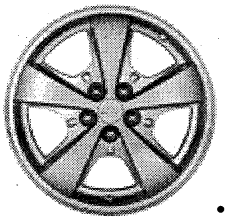
14-inch x 6-inch full wheel cover — standard on Coupe and Sedan models



• 15-inch x 6-inch full wheel cover — standard on LS Sedan and optional on Coupe



• 15-inch x 6-inch aluminum wheel – optional on Coupe and LS Sedan



• 16-inch x 6-inch aluminum wheels — standard on Z24 Coupe

Tires

- P195/70R-14 all-season tires (standard on Coupe and Sedan models)
- P195/65R-15 all-season Touring tires (standard on LS Sedan and optional on Cavalier Coupe with PEG 1SC only)
- P205/55R-16 Performance tires (standard on Z24 Coupe)
- Compact spare tire

Feature Availability

Interior Features	Coupe/Sedan	LS sedan	Z24 coupe
Air bags — driver and front-passenger(1)	S	S	S
Air conditioning — with CFC-free refrigerant	S	S	S
Cruise control	O(2)/NA	S	S
Defogger — rear-window, electric	S	S	S
Door locks — power	O(3)	O(3)	S
Easy entry passenger seat	O/NA	NA	S
Seat — front bucket and full-folding rear	S	S	S
Sunroof — power	O/NA	NA	O
Tilt-WheelTM steering column	O(2)/NA	S	S
Trunk release — mechanical/power	O/O(3)	S/O(3)	NA/S
Instrumentation			
— tachometer	O/NA	S	S
— trip odometer	S	S	S
Windows — power	O(2)/NA	O(2)	S
Sound Systems	**Coupe/Sedan**	**LS sedan**	**Z24 coupe**
NOTE: All sound systems feature an Electronically Tuned Receiver (ETR) and include a digital clock and seek-scan.			
AM/FM stereo	S	NA	NA
AM/FM stereo with compact disc player and TheftLock (includes premium front coaxial speaker)	O	S	S
AM/FM stereo with compact disc and remote cassette players, TheftLock, speed-compensated volume, auto tone control, and Radio Data System (RDS) (including Premium Amplified Audio System)	O	O	O
Six-speaker Premium Amplified Audio System with rear-woofer speakers	O	O	O
Exterior Features	**Coupe/Sedan**	**LS sedan**	**Z24 coupe**
Daytime Running Lamps	S	S	S
Foglamps	NA	NA	S
Mirrors outside — electric	O(2)/NA	O(2)	S
Moldings — body-side, body-color	O(2)	S	S
Mud guards — front	O(2)	S	NA
Paint — basecoat/clearcoat	S	S	S
Spoiler — rear decklid	O(4)/NA	O	S
Tires			
— P195/70R-14 all-season	S	NA	NA
— P195/65R-15 all-season Touring	O(2)/NA	S	NA
— P205/55R-16 all-season Performance	NA	NA	S
Wheel covers			
— 14-inch full	S	NA	NA
— 15-inch full	O(2)/NA	S	NA
Wheels			
— 15-inch aluminum	O/NA	O	NA
— 16-inch aluminum	NA	NA	S
Wipers — intermittent fixed	S	NA	NA
Wipers — intermittent variable	O(2)	S	S

Functional Features	Coupe/Sedan	LS sedan	Z24 coupe
Brake system — 4-wheel antilock (ABS)	S	S	S
Engine			
— 2200 L4 SFI	S	S	NA
— 2.4 Liter Twin Cam L4 SFI	NA	O	S
Exhaust system — stainless-steel	S	S	S
PASSlock® II theft-deterrent system	S	S	S
Remote Keyless Entry (includes power door locks and content theft alarm)	O	O	S
Steering — power rack-and-pinion	S	S	S
Transmission			
— 5-speed manual	S	NA	S
— 4-speed electronically controlled automatic with Traction Control	O(2)/O	S	O
Safety and Security Features	**Coupe/Sedan**	**LS sedan**	**Z24 coupe**
Air bags — driver and front-passenger(1)	S	S	S
Brake system — 4-wheel antilock (ABS)	S	S	S
Brake/transmission shift interlock (auto trans.)	S	S	S
Clutch/starter interlock switch (manual trans.)	S	S	S
Daytime Running Lamps	S	S	S
PASSlock® II theft-deterrent system	S	S	S
Remote Keyless Entry with content theft alarm	O	O	S

S – Standard. O – Optional (some options may be available only as part of a Preferred Equipment Group). NA – Not available. (1) Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information. (2) Requires optional PEG. (3) Requires optional PEG 1SD on Coupe and included with optional Remote Keyless Entry on Sedan and LS Sedan. (4) Included with optional Sport Package.

Specifications

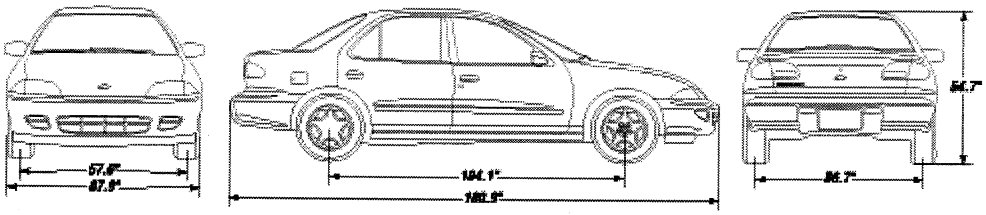
Engine Specifications	2200 L4 SFI	2.4 Liter Twin Cam L4
RPO	LN2	LD9
Displacement (liters/cu. in.)	2.2/134	2.4/146
Bore x stroke (in.)	3.50 x 3.46	3.54 x 3.70
Bore x stroke (mm)	89.0 x 88.0	90.0 x 94.0
Compression ratio	9.0:1	9.7:1
Cylinder block material	cast-iron	cast-iron
Cylinder head material	cast-aluminum	cast-aluminum
Valvetrain configuration	OHV	DOHC
Valves per cylinder	2	4
Induction system	SFI	SFI
Ignition system	electronic	electronic
Lifters	hydraulic roller	hydraulic
Cam drive	chain	chain
Coolant capacity (quarts/liters)	9.6/9.1	10.0/9.4
Oil capacity (quarts/liters)	4.0/3.8	4.0/3.8
Alternator rating (amps)	105	105
Battery (SAE rating, cca)	525	600
Recommended unleaded fuel	87 octane	87 octane
Maximum engine speed (RPM)	6000	6500
Horsepower/kW @ engine RPM	115/85 @ 5000	150/111 @ 5600
Torque (lb.-ft./N-m @ engine RPM)	135/100 @ 3600	155/115 @ 4400

Transmission Specifications	5-speed manual	4-speed electric automatic with OD and traction control
RPO	MM5	MN4
Gear ratio		
First gear	3.58	2.96
Second gear	2.02	1.63
Third gear	1.35	1
Fourth gear	0.98	0.68
Fifth gear	0.69	–
Reverse	3.31	2.14
Final drive ratio	3.94	3.63 (3.91 with 2.4L engine)
Fluid capacity (quarts/liters)	1.5/1.7	13.2/12.5 (dry)
Clutch size (in./mm)	–	–
– 2200 L4 engine	8.85/225	–
– 2.4 Liter engine	8.46/215	–
Converter size (in./mm)	–	9.6/245
Case material	aluminum	aluminum

Steering Specifications	
Ratio	
– Coupe/Sedan	14.7:1
– Z24	15.7:1
Turns stop-to-stop	
– Coupe/Sedan	2.6
– Z24	2.8
Turning diameter curb-to-curb (ft./m)	35.6/10.9

Brake Specifications		
Front Brakes	U.S. Standard	Metric
Rotor size (diam. x thick.)	10.2 x .79 in.	260 x 20 mm
Swept area	182.2 sq. in.	1175.6 sq. cm
Rear Brakes	U.S. Standard	Metric
Drum size (diam. x width)	7.87 x 1.77 in.	200 x 45 mm
Swept area	86.2 sq. in.	556.2 sq. cm

Dimensions



Exterior	Coupe	Sedan
Wheelbase	104.1/2644	104.1/2644
Length	180.9/4595	180.9/4595
Width	68.7/1745	67.9/1724
Height	53.0/1346	54.7/1389
Tread width		
– front	57.6/1463	57.6/1463
– rear	56.4/1432	56.7/1440

Interior	Coupe	Sedan
Wheelbase	104.1/2644	104.1/2644
Headroom		
– front	37.6/955	38.9/988
– rear	36.6/929	37.2/944
Legroom		
– front	41.9/1064	41.9/1064
– rear	32.7/830	34.4/873
Shoulder room		
– front	53.9/1369	54.6/1386
– rear	54.9/1394	53.9/1369
Hip room		
– front	50.0/1270	50.8/1290
– rear	49.5/1257	50.6/1285
Passenger volume (cu. ft./liters)	87.1/2473.3	91.5/2597.9
Cargo volume (cu. ft./liters)	13.2/374.8	13.6/386.1
Interior volume, EPA index (cu. ft./liters)	97.0/2746.7	105.0/2973.2

Capacities and Weights	Coupe	Sedan
Seating	5	5
Fuel tank cap. (gal./lit. approx.)	14.3/54.2	14.3/54.2
Curb weight, estimated (lbs./kg)	2617/1188	2676/1214

Trailering[1]	
Model	LS Sedan,
	Z24 (with automatic transmission)
Gross trailer weight (lbs./kg, up to)	1000/454
Max. tongue load (lbs./kg)	100/46

[1] Properly equipped. Maximum trailer weight is calculated by assuming only the driver is in the tow vehicle. Optional equipment, passengers or cargo will reduce the trailer weight rating.

Cavalier History

Introduced in spring 1981 as a 1982 model.

1983 – Cyclonic induction, fuel-injected 2.0 Liter engine; convertible debuts

1984 – Cavalier is the best-selling car in the U.S.

1985 – 2.8 Liter V6 introduced; major suspension tuning

1987 – Gen II 4- and 6-cylinder engines; Getrag 5-speed; Z24 Convertible for California only

1988 – Aerodynamic facelift for coupes and convertible; Z24 Convertible goes national

1991 – All-new interior and minor exterior changes; RS Convertible debuts

1992 – ABS VI brake system is standard; Z24 Convertible returns; Port Fuel Injection on L4

1994 – 2.2 Liter LN2 improvements; 3.1 Liter V6 option available on all Cavalier RS models

1995 – All-new interior and exterior design, new 2.3 Liter Quad 4 engine, 4T40-E transmission and standard dual air bags

1996 – New Daytime Running Lamps, 2.4 Liter Twin Cam engine; OBD II; extended-life coolant

1997 – Rally Sport Coupe model added, new easy-open gas cap, enhanced Evaporative Emissions Control system and federal dynamic side-impact standards met

1998 – Z24 Convertible replaces LS Convertible; Bi-Fuel Cavalier added to the model lineup

1999 – Refined 2.4 Liter Twin Cam engine

2000 – Exterior enhancements including body-color fascias on all models; air conditioning standard on all models; redesigned instrument panel cluster and rear-window defogger

Miscellaneous Information

Technical Product Information

Vehicle Classification

- Compact

Assembly Plant Locations

- Lordstown, Ohio

Frame

- Unitized

Chassis Layout

- Front engine, front-wheel drive

Body Material

- Steel

Affinity Relationships

- United States Figure Skating Association and U.S. Figure Skating Team
- U.S. Soccer
- GM Concept:Cure

Recreational Towing

Recreational towing, sometimes known as flat towing or dinghy towing, is the practice of towing a vehicle behind another vehicle where the vehicle in tow is on all four wheels. This is a common practice of motor home/recreational vacationers where a smaller vehicle is towed behind the motor home or coach to be used once the vacation spot is reached. Recreational towing is not to be confused with dolly towing. Dolly towing is the practice of placing one or both of the vehicle's axles on a dolly.

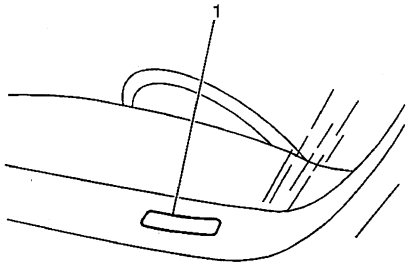
Recreational towing highlights and restrictions for the Cavalier:

- There are no engine or transmission restrictions
- Towing speed is limited to 65 mph, with no limitation on distance traveled
- The curb weight of the Cavalier must not exceed the trailer weight rating of the towing vehicle. Approximate curb weights can be found in the Capacities and Weights section.

NOTE: It is the responsibility of the owner to properly equip the towing and towed vehicles for recreational towing. See the Owner's Manual for restrictions and more information.

Vehicle Identification

Vehicle Identification Number (VIN)



The vehicle identification number (VIN) plate is the legal identifier of the vehicle. The VIN plate is located on the upper LH corner of the Instrument Panel and can be seen through the windshield from the outside of the vehicle:

Position	Definition	Character	Description
1	Country of Origin	1	U.S.A.
		3	Mexico
2	Manufacturer	G	General Motors
3	Make	1	Chevrolet
		2	Pontiac
4-5	Carline/Series	J/C	Cavalier
		J/F	Cavalier Z24 or LS
		J/B	Sunfire SE
		J/D	Sunfire GT
6	Body Style	1	2 Door Coupe (37)
		3	2 Door Convertible (67)
		5	4 Door Sedan (69)
7	Restraint System	2	Active (Manual) Belts w/Driver and Passenger Inflatable Restraint System
8	Engine Type	4	RPO LN2, 2.2L, L4, MFI
		T	RPO LD9, 2.4L, L4, MFI
9	Check Digit	--	Check Digit
10	Model Year	1	2001
11	Plant Location	M	Lansing, MI
		7	Lordstown, OH
		8	Lansing, MI
		S	Ramos Arizpe, MEX
12-17	Plant Sequence Number	--	Plant Sequence Number

VIN Derivative

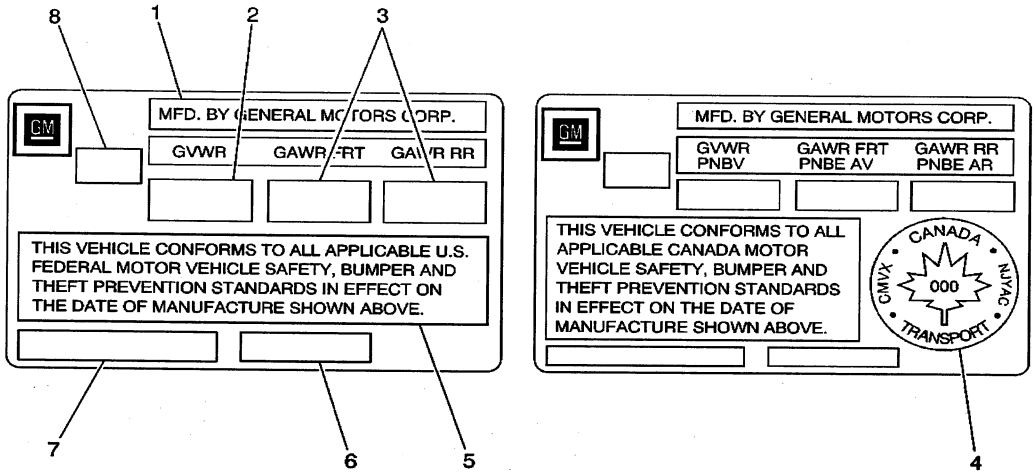
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	1	Chevrolet
		2	Pontiac
2	Model Year	1	2001
3	Assembly Plant	M	Lansing, MI
		7	Lordstown, OH
		8	Lansing, MI
		S	Ramos Arizpe, MEX
4-9	Plant Sequence Number	--	--

A VIN derivative can be used to determine if a vehicle contains the original engine or transmission, by matching the VIN derivative positions to their accompanying positions in the complete VIN:

VIN Derivative Position	Equivalent VIN Position
1	3
2	10
3	11
4-5	12-17

Label Certification


8
1
2
3
MFD. BY GENERAL MOTORS CORP.
GVWR
THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.
7
6
5
MFD. BY GENERAL MOTORS CORP.
GVWR PNBV
GAWR FRT PNBE AV
GAWR RR PNBE AR
THIS VEHICLE CONFORMS TO ALL APPLICABLE CANADA MOTOR VEHICLE SAFETY, BUMPER AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.
CANADA
000
TRANSPORT
4

1. Name of Manufacturer
2. Gross Vehicle Weight-Rating
3. Gross Axle Weight-Rating, Front, Rear
4. Canadian Safety Mark (w/RPO Z49)
5. Certification Statement
6. Vehicle Class Type (Pass Car, etc.)
7. Vehicle Identification Number
8. Date of Manufacture (Mo/Yr)

The vehicle certification label is permanently located on the edge of the driver's door. Refer to this label in order to obtain the following information:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR), front and rear

The Gross Vehicle Weight (GVW) must not exceed the Gross Vehicle Weight Rating (GVWR).

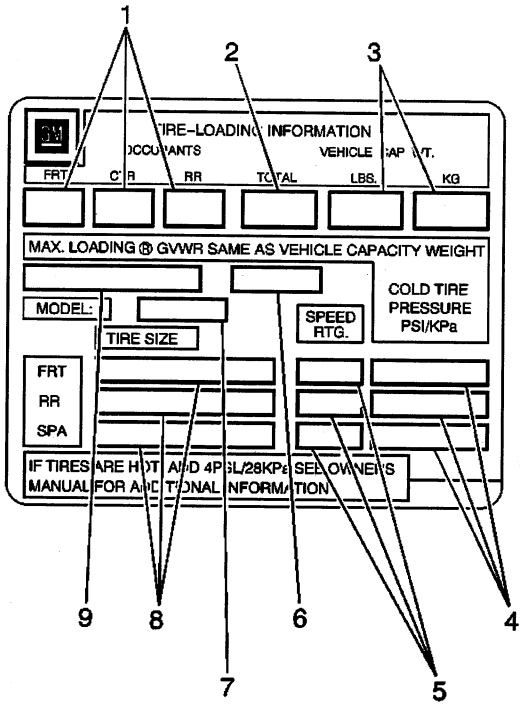
The GVW is the weight of the vehicle and everything the vehicle carries. Include the following items when figuring the GVW:

- The base vehicle weight (factory weight)
- The weight of any added vehicle accessories
- The weight of the driver and the passenger
- The weight of any cargo being carried

The front and rear Gross Axle Weights (GAW) must not exceed the Gross Axle Weight Ratings (GAWR), front and rear .

The GAW is the weight exerted on one of the axles (front or rear).

Tire Placard

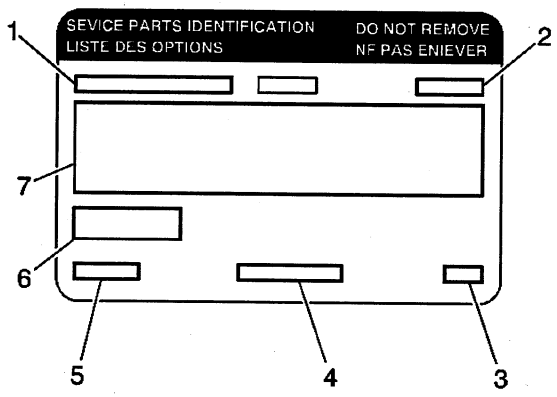


1. Specified Occupant Seating Positions
2. Total Occupant Seating
3. Maximum Vehicle Capacity Weight
4. Tire Pressures, Front, Rear, and Spare
5. Tire Speed Rating, Front, Rear, and Spare
6. Tire Label Code
7. Engineering Model Minus First Character
8. Tire Sizes, Front, Rear, and Spare
9. Vehicle Identification Number

The Tire Placard is permanently located on the edge of the driver's door. Refer to the placard in order to obtain the following information:

- The maximum vehicle capacity weight
- The cold tire inflation pressures
- The tire sizes--original equipment tires
- The tire speed ratings--original equipment tires

Service Parts Identification Label (SPID)

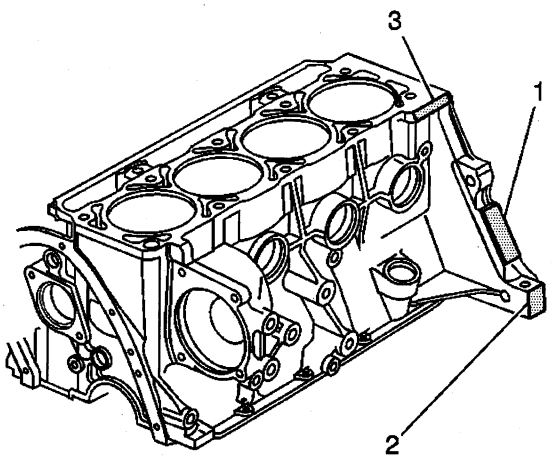


1. Vehicle Identification Number
2. Wheel Base
3. Part Number Location
4. Model Designation
5. Order Number
6. Exterior Color
7. Paint Technology

The service parts identification label is placed on the spare tire cover panel in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options.

Engine ID and VIN Derivative Location

2.2 L VIN 4 Engine ID Location



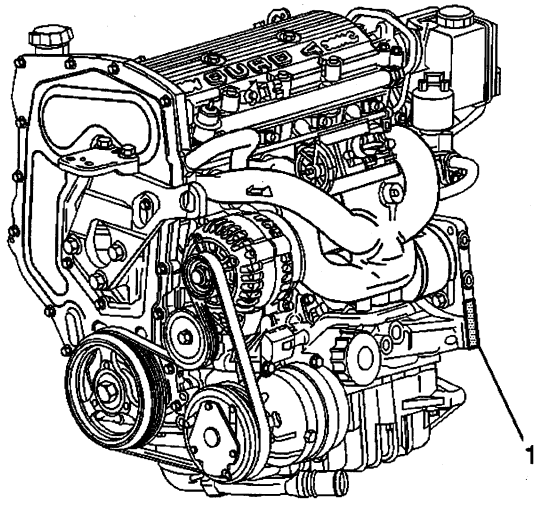
The engine code letter is the eight digit of the VIN, which identifies the engine.

Stick-on labels attached to the engine, laser etching, or stamping in the engine block indicate the engine unit number/build code date.

The Machine Marking Location (1) for the 2.2 L engine.

The primary (2) and secondary (3) hand stamp locations for the Vehicle Identification Number (VIN).

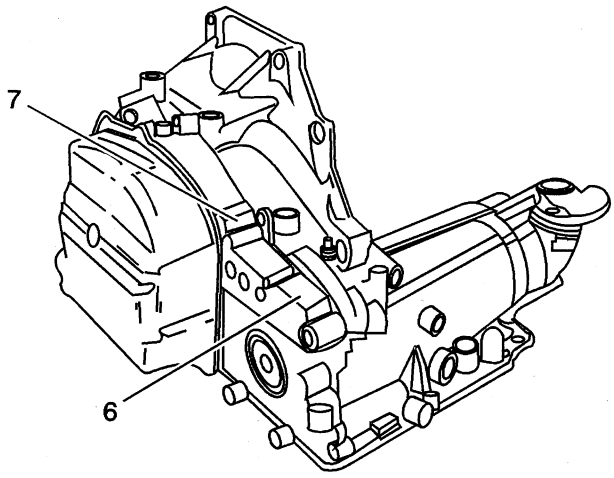
2.4 VIN T Engine ID Location

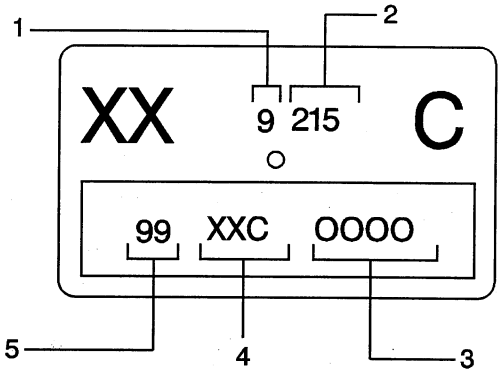


The 2.4 L VIN derivative and Engine ID (1) is located on the left side of the engine block next to the starter motor.

Transmission ID and VIN Derivative Location

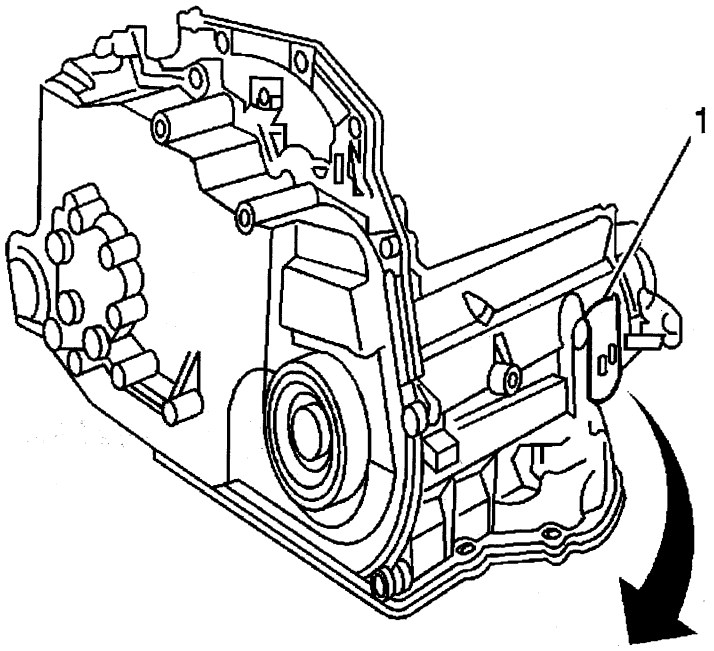
3T40 Transmission ID Location

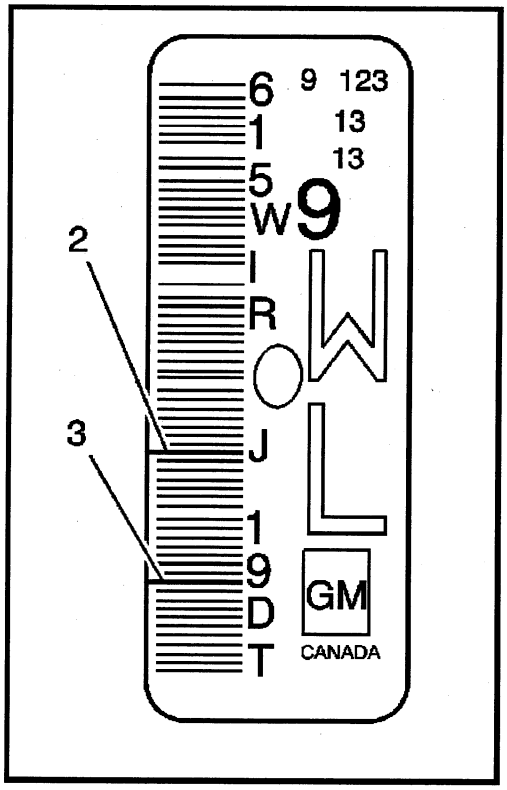




1. Calendar Year
2. Julian Date
3. Serial Number
4. Model
5. Model Year
6. Transmission ID Location
7. VIN Location

4T40E Transmission ID Location

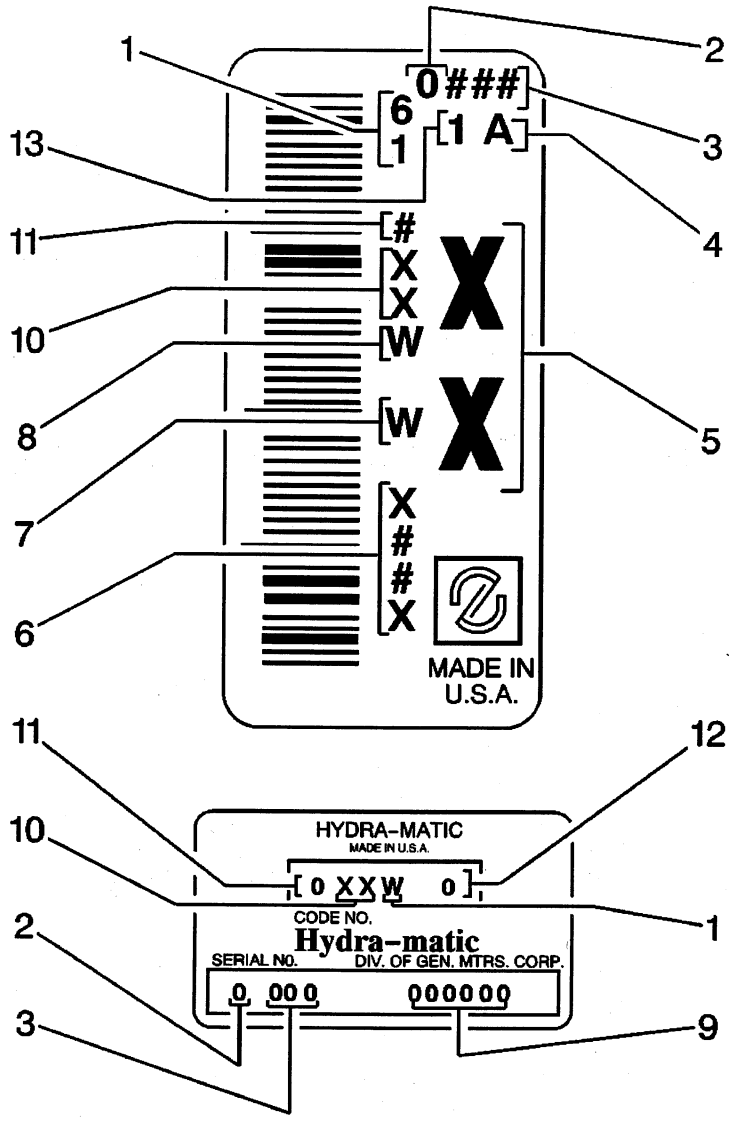




1. Goodwrech Tag Location
2. Remanufacturing Site Code
3. Serial Number

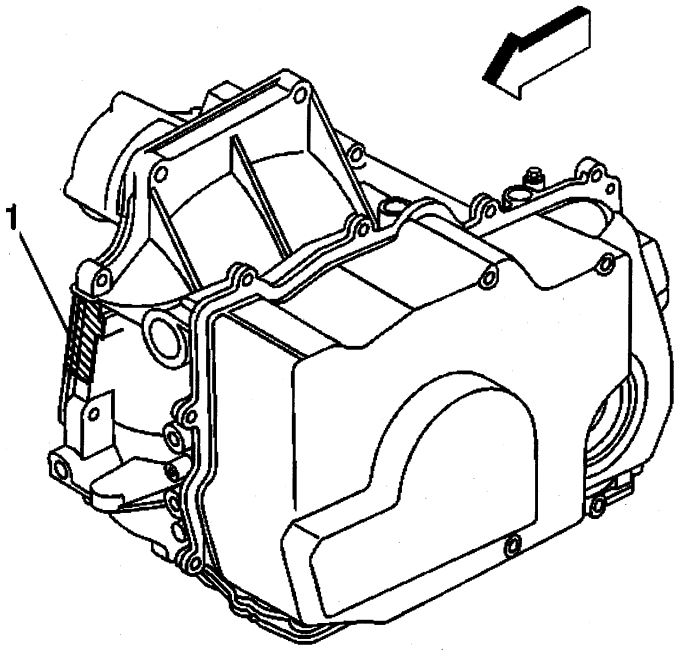
Automatic Transmission ID Nameplate

All automatic transmissions have a metal identification (ID) nameplate (1) attached to the case exterior.



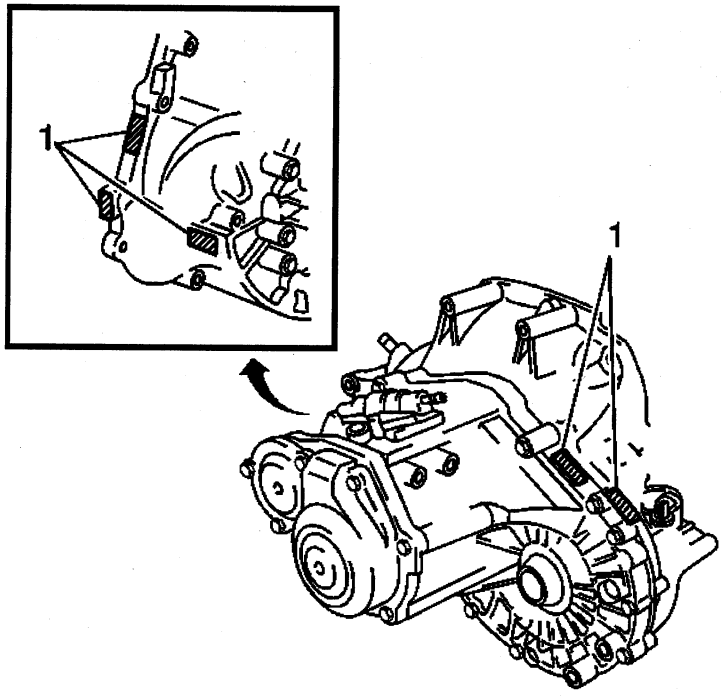
1. Transaxle
2. Calendar Year
3. Julian Date or Day of the Year
4. Shift (A=First Shift, B=Second Shift, C=Third Shift)
5. Model
6. Serial Number in Base Code 31
7. Plant
8. Hydramatic 4T40 E
9. Serial Number
10. Model
11. Model Year
12. Control Number
13. Line Built (1=Line 1, 2=Line 2, 3=Line 3, 4=Line 4)

VIN Derivative Location 4T40/4T45-E



The Location of the Vehicle Identification Number (VIN) Derivative (1).

Getrag 5T45-E Transmission VIN Location, M86



The various possible locations for the Getrag Vehicle Identification Number (VIN) Derivative.(1)

RPO Code List

The production/process codes provide the description of the Regular Production Options (RPOs) used on the vehicle. The RPO list is printed on the Service Parts Identification Label. The following is a list of the RPO abbreviations and the description of each:

RPO	Description
AF5	Easy Entry Seat Adjuster; Passenger Side
AK5	Restraint System Front Seat, Inflatable, Driver and Passenger
AR9	Seats; Bucket, Reclining
AS5	Seats; Deluxe Bucket, Reclining, with Driver Lumbar Adjust, Seat Back Pocket, Firmer Side Bolsters
AU0	Remote Keyless Entry
AU3	Power Door Locks
C41	HVAC, Heater System Outside Air, With Fan
C49	Defogger, Rear Window Electric
C60	HVAC, Air Conditioner Front Manual Controls
C95	Lamp Interior, Roof, Courtesy and Dual Reading
DC1	Mirror, Outside Left Hand and Right Hand Remote Control, Electric, Defog, Tinted Glass, Power, Foldaway, Painted
DC3	Mirror, Outside Left Hand and Right Hand Remote Control, Electric, Defog, Tinted Glass, Manual Foldaway, Painted
DC4	Mirror, Inside Rearview, Tilt, Dual Reading Lamps
DD2	Sunvisor Vanity Mirrors
DG7	Mirror, Outside, Remote Control, Electric, Color
DL5	Decal Roadside Service Information
DT3	Box Rear Storage Compartment
DT4	Ashtray Cigarette Lighter
D35	Mirror, Outside Remote Control, Color
FEO	Suspension System Front and Rear Active
FE1	Suspension System, Soft Ride
FE2	Suspension System, Ride Handling
FP2	Ratio Transaxle Final Drive, 3.58
FX1	Ratio Transaxle Final Drive, 3.94
FX2	Ratio Transaxle Final Drive, 3.91
FY1	Ratio Transaxle Final Drive, 3.63
IJC	Trim Interior Design (JC) (95)
IJN	Trim Interior Design (JN)
IPB	Trim Interior Design (PB)
IPD	Trim Interior Design (PD)
IPE	Trim Interior Design (PE)
IPG	Trim Interior Design (PG)
IPH	Trim Interior Design (PH)
IPJ	Trim Interior Design (PJ)
JA7	Park Brake Lever Handle, Leather Wrapped

JM4	Brake System Power, Front Disc, Rear Drum, Cast Iron, Antilock, Front and Rear Wheel
KL6	Provisions Natural Gas
KO5	Engine Block Heater
K29	Module Powertrain Control
K34	Cruise Control Automatic, Electronic
K62	Generator, CS 130-D, 105 Amp, Dual Internal Fan
LD9	Engine; 2.4L L4 DOHC
LN2	Engine Gas, 4 Cylinder, 2.2L, MFI
MD9	Transmission, Automatic 3 Speed, 3T40
MN4	Transmission, Automatic 4 Speed, 4T40E
M86	Transmission, 5 SPD. OPEL, F23, 5T45MI
M94	Transmission, 5 SPD. OPEL, F23, 5T45MI
NK5	Steering Wheel Standard
NP5	Steering Wheel Leather Wrapped
NW7	Traction Control; Powertrain Mgmt Only
N33	Stg Clm, Tilt
N46	Steering Wheel; Deluxe Urethane, w/SIR
N78	Wheel, 14 x 6, Aluminum, Hub Cap, Wheel Nuts
N81	Fullsize Spare Tire
PB1	Wheel Cover, 15 Inch
PC1	Wheel, 14 x 6, Aluminum
PF7	Wheel, 15 x 6, Aluminum Cast, Styled
PGO	Wheel 16 x 6, Aluminum, Styled
PG1	Wheel 14 x 6, Steel
OFB	P195/70 R14 All Season, Black Wall Tires
QLG	P205/55 R16 Performance; Black Wall Tire
QPD	P195/65 R15 Touring; Black Wall Tires
T43	Spoiler Rear
T79	Fog Lamp, Rear
T84	Headlamps Right Hand Rule of the Road, E Mark
UD4	Alarm Vehicle Speed, 120 K/H
UH7	Cluster Instrument, Cool Temp
UH8	Cluster Instrument, Cool Temp, Trip Odom, Tach
UJ5	Cluster Instrument, Cool Temp, Trip Odom, Tach, Fuel, Speedo, Analog, Metric Only
UK3	Radio Control; Redundant on Steering Wheel
UL0	Radio, AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Auto Tone, Clock
UM6	Radio; AM/FM Stereo Seek/Scan, Auto Reverse, Cassette, Clock
UM7	Radio, AM/FM Stereo, Seek/Scan, Clock
UN0	Radio, AM/FM, Stereo, Seek/Scan, Compact Disc, Auto Tone, Clock
UN6	Radio, AM/FM, Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Clock
UP3	Radio, AM/FM, Stereo, Seek/Scan, Compact Disc, Equalizer, Clock
UQ9	Speaker Delete

US6	Antenna Fixed, Painted, Radio
UT6	Radio; AM/FM Stereo, Seek/Scan Auto Reverse Music Search, Cassette, Equalizer, Clock
UW6	6 Speaker System, Dual F/D Tweet and Woof, Dual Extended Range Shelf
UX7	Speaker System 4, Dual Front Door Mounted, Dual Extended Range Package Shelf
U19	Metric Scale Instrument Cluster
U77	Antenna Rear Window, Radio
U79	Speakers (4), 2 Rear Shelf, 1 Coaxial per Door
VD9	Fascia Front and Rear, Body Color
VG9	Protector Wax, Exterior Body
VH4	Front Mud Guards
VH9	Envelope Owner Information Manual
VK3	Front License Plate Mounting Provisions
VP6	Noise Control
VR6	Hook Tie Down
VY7	Leather Shift Knob
V05	Radiator Heavy Duty
01L	Secondary Color Exterior, Special (91)
10I	Interior Trim Arctic White (93)
10N	Trim Combination Vinyl, Arctic White (N) (93)
12B	Trim Combination Cloth, Graphite (B) (95)
12C	Trim Combination Cloth Graphite (C) (94)
12D	Trim Combination Cloth, Graphite (D) (95)
12E	Trim Combination Cloth, Graphite (E) (92)
12G	Trim Combination Cloth, Graphite (G) (96)
12H	Trim Combination Cloth, Graphite (H) (96)
12I	Interior Trim Graphite (95)
12J	Trim Combination Cloth, Graphite (J) (98)
16T	Top Color Bright White (94)
16U	Primary Color Exterior, Brite White (91)
22U	Primary Color Exterior, Dahlia Blue Met (97)
24U	Primary Color Exterior, Opal Blue (97)
36U	Primary Color Exterior, Fern Green Mint (99)
37U	Primary Color Exterior, Manta Green Met (96)
41T	Top Color Black (91)
41U	Primary Color Exterior, Black (94)
49U	Primary Color Exterior, Light Sandrift Met (96)
52B	Trim Combination Cloth, Light Neutral (B) (92)
52C	Trim Combination Cloth, Light Neutral (C) (95)
52D	Trim Combination Cloth, Light Neutral (D) (96)
52E	Trim Combination Cloth, Light Neutral (E) (96)
52G	Trim Combination Cloth, Light Neutral (G) (96)
52H	Trim Combination Cloth, Medium Neutral II (H) (96)

52I	Interior Trim, Light Neutral (I) (92)
52N	Trim Combination Vinyl, Light Neutral (N) (96)
52T	Top Color Neutral
6OU	Primary Color Exterior, Gold Firemist (98)
8X1	Label Fastener Seat Belts
81U	Primary Color Exterior, Bright Red (91)
92B	Trim Combination Cloth, Pewter (B) (97)
92E	Trim Combination Cloth, Medium Dark Pewter (97) (E)
92G	Trim Combination Cloth, Medium Dark Pewter (97) (G)
92H	Trim Combination Cloth, Medium Dark Pewter (97) (H)
92I	Interior Trim Pewter (97)
96U	Primary Color Exterior, Cayenne Red Metallic (96)

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Cooling System		
Engine Cooling, 2.2L	9.6 L	10.2 qt
Engine Cooling, 2.4L	9.6 L	10.2 qt
Engine Crankcase		
With Filter	3.8 L	4.0 qt
Fuel System		
Fuel Tank	54.1 L	14.3 gal
Power Steering System	0.70 L	1.5 pt
Transaxle		
3T40 Transaxle Bottom Pan Removal	3.8 L	4.0 qt
3T40 Transaxle Complete Overhaul	6.6 L	7.0 qt
4T40E/4T45E Transaxle Bottom Pan Removal	6.5 L	6.9 qt
4T40E/4T45E Transaxle Complete Overhaul	9.0 L	9.5 qt
Manual Transaxle Complete Drain and Refill	1.7 L	1.8 qt

Tire Inflation Pressure Specifications

Application	Specification	
	Metric	English
Tire Inflation; Compact Spare	420 kPa	60 psi
Tire Inflation; Front Tires	210 kPa	30 psi
Tire Inflation; Rear Tires	210 kPa	30 psi

Maintenance Items

Application	Specification
Air Cleaner Filter, 2.2L	AC Type A-1172C
Air Cleaner Filter, 2.4L	AC Type A-1172C
Engine Oil Filter, 2.2L	AC Type PF47
Engine Oil Filter, 2.4L	AC Type PF44
Spark Plug and Gap, 2.2L	AC Type 41-928, 1.27 mm (0.050 in) Gap
Spark Plug and Gap, 2.4L	AC Type 41-963, 1.27 mm (0.050 in) Gap
Windshield Wiper Blades	
Driver's Side	Shepherd's Hook Type 56 cm (22 in)
Passengers's Side	Shepherd's Hook Type 43 cm (17 in)

Fluid and Lubricant Recommendations

Application	Fluid/Lubricant
Automatic Transaxle	DEXRON®-III Automatic Transaxle Fluid
Chassis Lubrication	Chassis Lubrication GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Clutch Linkage Pivot Points	Engine oil
Engine Coolant	50/50 mixture of clean, drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® coolant
Engine Oil	Engine oil with the American Petroleum Institute Certified for Gasoline Engines "Starburst" symbol of the proper viscosity. To determine the preferred viscosity for your vehicle's engine, refer to Engine Oil Viscosity in your owner's manual.
Hinges, Hood and Door	Multi-Purpose Lubricant, Superlube ® GM P/N 12346241 or equivalent
Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor and Release Pawl	Lubriplate ® Lubricant Aerosol GM P/N 12346293 or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Hydraulic Brake System	Delco Supreme 11® Brake Fluid GM P/N 12377967 or equivalent DOT-3 brake fluid
Hydraulic Clutch System	Hydraulic Clutch Fluid GM P/N 12345347 or equivalent DOT-3 Brake Fluid
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube ® GM P/N 12346241
Manual Transaxle	Dexron® III-Automatic Transaxle Fluid
Manual Transaxle Shift Linkage	Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Power Steering System	GM Power Steering Fluid GM P/N 1052884 - 1 pint or 1050017 - 1 quart, or equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 or equivalent
Windshield Washer Solvent	GM Optikleen® Washer Solvent GM P/N 1051515 or equivalent

Tire and Wheel Runout Specifications

Application	Specification	
	Metric	English
Tire and Wheel Assembly - Lateral and Radial		
• Off-Vehicle	1.27 mm	0.050 in
• On-Vehicle	1.52 mm	0.060 in
Wheel, Aluminum		
• Lateral	0.762 mm	0.030 in
• Radial	0.762 mm	0.030 in
Wheel, Steel		
• Lateral	1.143 mm	0.045 in
• Radial	1.015 mm	0.040 in
Wheel Hub/Axle Flange - Guideline	0.132 mm	0.0052 in
Wheel Stud - Guideline	0.25 mm	0.010 in

Descriptions and Operations

Power Steering System Description and Operation w/o Electro-Hydraulic Steering

The hydraulic power steering pump is a constant displacement vane-type pump that provides hydraulic pressure and flow for the power steering gear. The hydraulic power steering pumps are either belt-driven or direct-drive, cam-driven.

The power steering fluid reservoir holds the power steering fluid and may be integral with the power steering pump or remotely located. The following locations are typical locations for the remote reservoir:

- Mounted to the front of the dash panel
- Mounted to the inner fender
- Mounted to a bracket on the engine

The 2 basic types of power steering gears are listed below:

- A recirculating ball system
- A rack and pinion system

In the recirculating ball system, a worm gear converts steering wheel movement to movement of a sector shaft. A pitman arm attached to the bottom of the sector shaft actually moves one tie rod and an intermediate rod move the other tie rod.

In the rack and pinion system, the rack and the pinion are the 2 components that convert steering wheel rotation to lateral movement. The steering shaft is attached to the pinion in the steering gear. The pinion rotates with the steering wheel. Gear teeth on the pinion mesh with the gear teeth on the rack. The rotating pinion moves the rack from side to side. The lateral action of the rack pushes and pulls the tie rods in order to change the direction of the vehicle's front wheels.

The power steering pressure hose connects the power steering pump union fitting to the power steering gear and allows pressurized power steering fluid to flow from the pump to the gear.

The power steering return hose returns fluid from the power steering gear back to the power steering fluid reservoir. The power steering return line may contain an integral fin-type or line-type power steering fluid cooler.

In a typical power steering system, a pump generates hydraulic pressure, causing fluid to flow, via the pressure hose, to the steering gear valve assembly. The steering gear valve assembly regulates the incoming fluid to the right and left chambers in order to assist in right and left turns.

Turning the steering wheel activates the valve assembly, which applies greater fluid pressure and flow to 1 side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front wheels, which turn the vehicle right or left.

Steering Wheel and Column - Standard Description and Operation

The steering wheel and column has 4 primary functions:

- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Vehicle Steering

The steering wheel is the first link between the driver and the vehicle. The steering wheel is fastened to a steering shaft within the column. At the lower end of the column, the intermediate shaft connects the column to the steering gear.

Vehicle Security

Theft deterrent components are mounted and designed into the steering column. The following components allow the column to be locked in order to minimize theft:

- The ignition switch
- The steering column lock
- The ignition cylinder

Driver Convenience

The steering wheel and column may also have driver controls attached for convenience and comfort. The following controls may be mounted on or near the steering wheel or column.

- The turn signal switch
- The hazard switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad/cruise control switch
- The redundant radio/entertainment system controls
- The tilt or tilt/telescoping functions
- The HVAC controls

Driver Safety

The energy-absorbing steering column compresses in the event of a front-end collision, which reduces the chance of injury to the driver. The mounting capsules break away from the mounting bracket in the event of an accident.

Suspension Description and Operation

Front Suspension

The front suspension has 2 primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicles ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's horizontal relationship to the road.

This requires that the steering knuckle be suspended between a lower control arm and a strut assembly. The lower control arm attaches from the steering knuckle at the outermost point of the control arm. The attachment is through a ball and socket type joint. The innermost end of the control arm attached at 2 points to the vehicle frame through semi-rigid bushings. The upper portion of the steering knuckle is

attached to a strut assembly. The strut assembly then connects to the vehicle body by way of an upper bearing. The steering knuckle is allowed to travel up and down independent of the vehicle body structure and frame.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A strut is a basic hydraulic cylinder. The strut is filled with oil and has a moveable shaft that connects to a piston inside the strut. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion to utilize this recoil action of a spring alone. Each end of the strut is designed as the connection point of the suspension system to the vehicle and acts as the coil spring seat. This allows the strut to utilize the dampening action to reduce the recoil of a spring alone. The lower control arm is allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicles handling characteristics on turns.

Rear Suspension

This vehicle has a semi-independent rear suspension which consists of the following components:

- An axle with trailing arms
- A twisting cross beam
- 2 coil shocks

The axle assembly attaches to the underbody through a rubber bushing located at the front of each control arm. The brackets are integral with the underbody side rails. The axle structure itself maintains the geometrical relationship of the wheels relative to the inside of the body. The stabilizer shaft is attached to the inside of the axle beam.

The coil springs support the weight of the vehicle in the rear. A rubber insulator isolates the coil spring upper spring seat.

The lower ends of the coil-over shocks are attached to the axle assembly, by a bracket which has a stud that is fastened to the axle using a nut. The upper ends are attached to the body of the car. The top of the coil-over shock has an insulator which is bolted to the body near the wheel-house area. The coil-over shock absorbers are non-adjustable and non-refillable. Service of the coil-over shocks require replacement of the inner shock assembly. This is when they have lost their resistance, are damaged or are leaking.

A single hub and bearing assembly is bolted to both ends of the rear axle assembly or the rear knuckle assembly. This hub and bearing assembly is a sealed unit which eliminated the need for wheel bearing adjustments and does not require periodic maintenance.

Wheels and Tires

General Description

The factory installed tires are designed to operate satisfactorily with loads up to and including the full rated load capacity when these tires are inflated to the recommended pressures.

The following factors have an important influence on tire life:

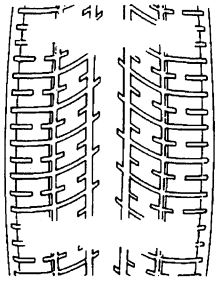
- Correct tire pressures

- Correct wheel alignment
- Proper driving techniques
- Tire rotation

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description



The original equipment tires have tread wear indicators that show when you should replace the tires.

The location of these indicators are at 72 degree intervals around the outer diameter of the tire. The indicators appear as a 6 mm (0.25 in) wide band when the tire tread depth becomes 1.6 mm (2/32 in).

Metric Wheel Nuts and Bolts Description

Metric wheel/nuts and bolts are identified in the following way:

- The wheel/nut has the word Metric stamped on the face.
- The letter M is stamped on the end of the wheel bolt.

The thread sizes of metric wheel/nuts and the bolts are indicated by the following example: M12 x 1.5.

- M = Metric
- 12 = Diameter in millimeters
- 1.5 = Millimeters gap per thread

Tire Inflation Description

When you inflate the tires to the recommended inflation pressures, the factory-installed wheels and tires are designed in order to handle loads to the tire's rated load capacity. Incorrect tire pressures, or under-inflated tires, can cause the following conditions:

- Vehicle handling concerns
- Poor fuel economy
- Shortened tire life
- Tire overloading

Inspect the tire pressure when the following conditions apply:

- The vehicle has been sitting at least 3 hours.
- The vehicle has not been driven for more than 1.6 km (1 mi).
- The tires are cool.

Inspect the tires monthly or before any extended trip. Adjust the tire pressure to the specifications on the tire label. Install the valve caps or the extensions on the valves. The caps or the extensions keep out dust and water.

The kilopascal (kPa) is the metric term for pressure. The tire pressure may be printed in both kilopascal (kPa) and psi. One psi equals 6.9 kPa.

Inflation Pressure Conversion (Kilopascals to PSI)

kPa	psi	kPa	psi
140	20	215	31
145	21	220	32
155	22	230	33
160	23	235	34
165	24	240	35
170	25	250	36
180	26	275	40
185	27	310	45
190	28	345	50
200	29	380	55
205	30	415	60
Conversion: 6.9 kPa = 1 psi			

Tires with a higher than recommended pressure can cause the following conditions:

- A hard ride
- Tire bruising
- Rapid tread wear at the center of the tire

Tires with a lower than recommended pressure can cause the following conditions:

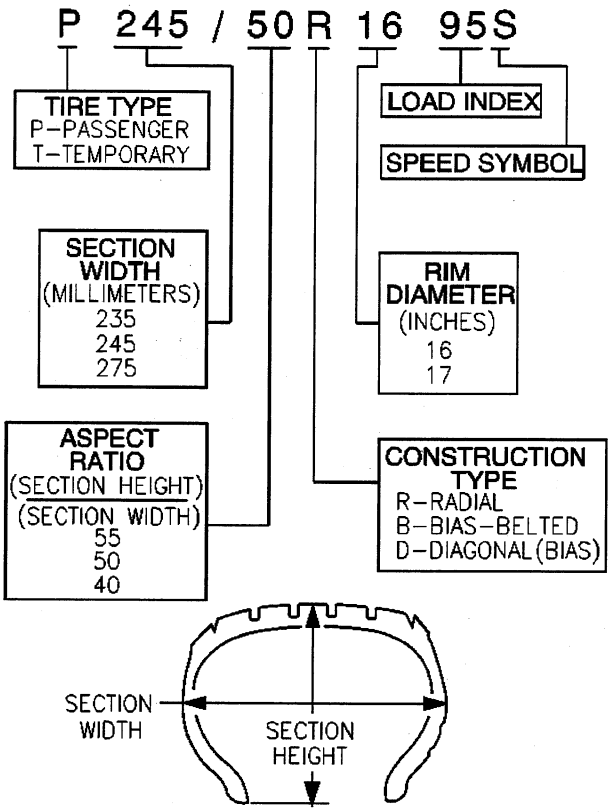
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures
- Reduced vehicle handling
- High fuel consumption
- Soft riding

Unequal pressure on the same axle can cause the following conditions:

- Uneven braking
- Steering lead
- Reduced vehicle handling

Refer to the Tire Placard for specific tire and wheel applications and tire pressures.

P-Metric Sized Tires Description



Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same tire performance criteria (TPC) specification number including the same size, the same load range, and the same construction as those originally installed on the vehicle. Consult a tire dealer if you must replace the P-metric tire with other sizes. Tire companies can best recommend the closest match of alphanumeric to P-metric sizes within their own tire lines.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

Hydraulic output pressure is distributed from the master cylinder through two hydraulic circuits, supplying diagonally-opposed wheel apply circuits.

Hydraulic Brake Pressure Balance Control System

Regulates brake fluid pressure delivered to hydraulic brake wheel circuits, in order to control the distribution of braking force.

Pressure balance control is achieved through dynamic rear proportioning (DRP), which is a function of the ABS modulator.

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

Mechanical force is converted into hydraulic pressure by the master cylinder, regulated to meet braking system demands by the pressure balance control system, and delivered to the hydraulic brake wheel circuits by the pipes and flexible hoses. The wheel apply components then convert the hydraulic pressure back into mechanical force which presses linings against rotating brake system components.

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

Receives, multiplies and transfers brake system input force from driver.

Brake Pedal Pushrod

Transfers multiplied input force received from brake pedal to brake booster.

Vacuum Brake Booster

Uses source vacuum to decrease effort required by driver when applying brake system input force.

When brake system input force is applied, air at atmospheric pressure is admitted to the rear of both vacuum diaphragms, providing a decrease in brake pedal effort required. When input force is removed, vacuum replaces atmospheric pressure within the booster.

Vacuum Source

Supplies force used by vacuum brake booster to decrease brake pedal effort.

Vacuum Source Delivery System

Enables delivery and retention of source vacuum for vacuum brake booster.

System Operation

Brake system input force is multiplied by the brake pedal and transferred by the pedal pushrod to the hydraulic brake master cylinder. Effort required to apply the brake system is reduced by the vacuum brake booster.

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

Applies mechanical output force from the hydraulic brake calipers to friction surfaces of brake rotors.

Disc Brake Rotors

Uses mechanical output force applied to friction surfaces from the disc brake pads to slow speed of tire and wheel assembly rotation.

Disc Brake Pad Hardware

Secures disc brake pads firmly in proper relationship to the hydraulic brake calipers. Enables a sliding motion of brake pads when mechanical output force is applied.

Disc Brake Caliper Hardware

Provides mounting for hydraulic brake caliper and secures the caliper firmly in proper relationship to caliper bracket. Enables a sliding motion of the brake caliper to the brake pads when mechanical output force is applied.

System Operation

Mechanical output force is applied from the hydraulic brake caliper pistons to the inner brake pads. As the pistons press the inner brake pads outward, the caliper housings draw the outer brake pads inward. This allows the output force to be equally distributed. The brake pads apply the output force to the friction surfaces on both sides of the brake rotors, which slows the rotation of the tire and wheel assemblies. The correct function of both the brake pad and brake caliper hardware is essential for even distribution of braking force.

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

Applies mechanical output force (from hydraulic brake wheel cylinders) to friction surface of brake drums.

Brake Drums

Uses mechanical output force applied to friction surface from drum brake shoes to slow speed of tire and wheel assembly rotation.

Drum Brake Hardware

Secures drum brake shoes firmly in proper relationship to hydraulic brake wheel cylinders. Enables sliding motion of brake shoes needed to expand toward friction surface of drums when mechanical output force is applied; provides return of brake shoes when mechanical output force is relieved.

Drum Brake Adjusting Hardware

Provides automatic adjustment of brake shoes to brake drum friction surface whenever brake apply occurs during rearward motion of the vehicle.

System Operation

Mechanical output force is applied from the hydraulic brake wheel cylinder pistons to the top of the drum brake shoes. The output force is then distributed between the primary and secondary brake shoes as the shoes expand toward the friction surface of the brake drums. The brake shoes apply the output force to the friction surface of the brake drums, which slows the rotation of the tire and wheel assemblies. The proper function of both the drum brake hardware and adjusting hardware is essential to the proper distribution of braking force.

Park Brake System Description and Operation

System Component Description

The park brake system consists of the following:

Park Brake Lever Assembly

Receives, multiplies, and transfers park brake system apply input force from operator to park brake cable system.

Releases applied park brake system when lever is returned to at-rest, lowered, position.

Park Brake Cables

Transfers input force received from park brake lever, through park brake cable equalizer, to park brake apply levers.

Park Brake Cable Equalizer

Evenly distributes input force to both the left and right park brake units.

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator/adjuster.

Park Brake Actuator/Adjuster

Uses multiplied input force from apply lever to expand drum brake shoes toward the friction surface of the brake drum.

Threaded park brake actuators/adjusters are also used to control clearance between the drum brake shoes and the friction surface of the brake drum.

Drum Brake Shoes

Applies mechanical output force from park brake actuator/adjuster to friction surface of the brake drum.

System Operation

Park brake apply input force is received by the park brake lever assembly being applied. The input force is multiplied by the lever assembly, transferred, and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators/adjusters which expand the drum brake shoes toward the friction surface of the brake drum in order to prevent the rotation of the rear tire and wheel assemblies. The park brake lever assembly releases an applied park brake system when it is returned to the at-rest, lowered, position.

ABS Description and Operation

Antilock Brake System

When wheel slip is detected during a brake application, the ABS enters antilock mode. During antilock braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold, or increase hydraulic pressure to each wheel brake. The ABS cannot, however, increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During antilock braking, a series of rapid pulsations is felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during antilock braking and stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During antilock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during antilock operation.

Vehicles equipped with ABS may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking is no different than that of previous non-ABS systems. Maintaining a constant force on the brake pedal provides the shortest stopping distance while maintaining vehicle stability.

Engine Description and Operation

Engine Mechanical – 2.2L

Application	Specifications	
	Metric	English
General Data		
Engine Type	L-4	
Regular Production Option (RPO) Code LN2 VIN Code 4/L43 VIN Code 5		
Displacement	2.2 L	134 CID
Bore	89 mm	3.5 in
Stroke	88 mm	3.46 in
Compression Ratio	9:1	
Firing Order	1-3-4-2	
Oil Pressure @ 65°C (150°F)	348 kpa	56 psi @ 3000 RPM

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accessory Drive Belt Idler Pulley	50 N·m	37 lb ft
Air Conditioning Compressor Mounting Bolts	54 N·m	40 lb ft
Camshaft Sprocket Bolt	130 N·m	96 lb ft
Crankcase Front Cover Bolts	11 N·m	97 lb in
Crankshaft Pulley Hub to Crankshaft Bolts	105 N·m	77 lb ft
Crankshaft Pulley to Hub Bolt	50 N·m	37 lb ft
Cylinder Head Bolts -- Long		
• First Pass	63 N·m	46 lb ft
• Final Pass	90 degrees	
Cylinder Head Bolts -- Short		
• First Pass	58 N·m	43 lb ft
• Final Pass	90 degrees	
Engine Bracket to Mount Bolt	60 N·m	44 lb ft
• Final Pass	90 degrees	
Engine Mount to Body Nut	75 lbN·m	55 lb ft
Engine Mount Strut Bolts	100 lbN·m	74 lb ft
• Final Pass	90 degrees	
Engine Mount Strut Bracket Bolts	66 N·m	49 lb ft
Flywheel Bolts	75 N·m	55 lb ft
Fuel Inlet Pipe Bolt	24 N·m	17 lb ft
Intake Manifold Bolts	24 N·m	17 lb ft
Intake Manifold Nuts	24 N·m	17 lb ft
Intake Manifold Studs	12 N·m	105 lb in
Lifter Guide	11 N·m	97 lb in

Negative Battery Cable Bolt	16 N·m	12 lb ft
Oil Fill Tube	50 N·m	37 lb ft
Oil Filter	17 N·m	13 lb ft
Oil Filter Adapter	35 N·m	26 lb ft
Oil Pan	10 N·m	89 lb in
Oil Pan Drain Bolt	26 N·m	19 lb ft
Oil Pump Cover Bolts	10 N·m	89 lb in
Oil Pump Drive Assembly	25 N·m	18 lb ft
Oil Pump Mounting Bolt	44 N·m	32 lb ft
Resonator Nut	25 N·m	19 lb ft
Rocker Arm Bolts	25 N·m	19 lb ft
Rocker Arm Cover Bolts	10 N·m	89 lb in
Serpentine Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Spark Plugs	17 N·m	13 lb ft
Timing Chain Tensioner Bolts	24 N·m	18 lb ft
Transmission Bolts	75 N·m	55 lb ft

Drive Belt System Description

The drive belt system consists of the following components:

- The drive belt
- The drive belt tensioner
- The drive belt idler pulley
- The crankshaft balancer pulley
- The accessory drive component mounting brackets
- The accessory drive components
  - The power steering pump, if belt driven
  - The generator
  - The A/C compressor, if equipped
  - The engine cooling fan, if belt driven
  - The water pump, if belt driven
  - The vacuum pump, if equipped
  - The air compressor, if equipped

The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers (chloroprene or EPDM) and have different layers or plys containing either fiber cloth or cords for reinforcement.

Both sides of the drive belt may be used to drive the different accessory drive components. When the back side of the drive belt is used to drive a pulley, the pulley is smooth.

The drive belt is pulled by the crankshaft balancer pulley across the accessory drive component pulleys. The spring loaded drive belt tensioner keeps constant tension on the drive belt to prevent the drive belt from slipping. The drive belt tensioner arm will move when loads are applied to the drive belt by the accessory drive components and the crankshaft.

The drive belt system may have an idler pulley, which is used to add wrap to the adjacent pulleys. Some systems use an idler pulley in place of an accessory drive component when the vehicle is not equipped with the accessory.

Engine Mechanical – 2.4L

Application	Specification	
	Metric	English
General Data		
Engine Type	Inline 4 Cylinder	
Displacement	2.4 L	146 CID
Regular Production Option (RPO) Code LD9 VIN Code T		
Bore	90 mm	3.54 in
Stroke	94 mm	3.70 in
Compression Ratio	9.5 to 1	
Firing Order	1-3-4-2	
Do Not Resurface if the Overall Measurement is Less Than	0.076 mm	0.003 in
Resurface the Head if the Overall Measurement is More Than	0.076-0.25 mm	0.003-0.010 in
Lubricating System		
Oil Pressure @ 3,000 RPM	207 kPa	30 psi min
Oil Pressure @ 900 RPM	69 kPa	10 psi min

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Camshaft Housing Cover to Camshaft Housing Bolt (First pass)	15 N·m	11 lb ft
• Final Pass	30 degrees	
Camshaft Housing to Cylinder Head Bolt (First pass)	15 N·m	11 lb ft
• Final Pass	90 degrees	
Camshaft Sprocket Bolt	70 N·m	52 lb ft
Crankshaft Balancer Bolt (First pass)	175 N·m	129 lb ft
• Final Pass	90 degrees	
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Brace to Transmission Bolt	50 N·m	37 lb ft
Engine Front Cover Bolt	13 N·m	115 lb in
Engine Mount to Body Nut	75 N·m	55 lb ft
Engine Mount Bracket Adapter Bolt (First pass)	60 N·m	44 lb ft
• Final Pass	60 degrees	
Engine Mount Bracket to Engine Block Bolt (Side)	58 N·m	43 lb ft
Engine Mount Bracket to Engine Block Bolt (Front)	102 N·m	75 lb ft
Engine Mount Bracket to Transaxle Bolt	75 N·m	55 lb ft
Engine Mount to Engine Mount Bracket (First pass)	60 N·m	44 lb ft
• Final Pass	90 degrees	
Engine Mount Strut Bolt (First pass)	100 N·m	74 lb ft
• Final Pass	90 degrees	
Engine Mount Strut Bracket Bolt	66 N·m	49 lb ft
Flywheel Bolt (First pass)	30 N·m	22 lb ft

• Final Pass	45 degrees	
Fuel Rail to Camshaft Housing Bolt	26 N·m	19 lb ft
Ignition Coil/Module Cover to Camshaft Housing Bolt (First pass)	15 N·m	11 lb ft
• Final Pass	30 degrees	
Intake Camshaft Sprocket Bolt	70 N·m	52 lb ft
Intake Manifold Bolt/Nut	24 N·m	18 lb ft
Oil/Air Separator to Engine Block Bolt	24 N·m	17 lb ft
Oil Filter Adapter	29 N·m	21 lb ft
Oil Level Indicator Tube Nut	8 N·m	72 lb in
Oil Pan Bolt	26 N·m	19 lb ft
• M8 x 1.25 x 80	24 N·m	18 lb ft
• M8 x 1.25 x 22	24 N·m	18 lb ft
• M6 x 1.00 x 25	12 N·m	106 lb in
Oil Pan Drain Bolt	26 N·m	19 lb ft
Oil Pan to Seal Housing Bolt	12 N·m	106 lb in
Oil Pump Cover to Balance Shaft Housing Bolt	54 N·m	40 lb ft
Timing Chain Housing Bolt		
• M8 x 1.25 x 25 Bolt	26 N·m	19 lb ft
• M8 x 1.55 x 55 Bolt	50 N·m	37 lb ft
• M10 x 1.25 x 35 Bolt	29 N·m	21 lb ft
• M8 x 1.25 x 80 Bolt	24 N·m	18 lb ft
• M8 x 1.24 x 22 Bolt	24 N·m	18 lb ft
• M6 x 1.00 x 25 Bolt	12 N·m	106 lb in
Timing Chain Housing Nut	26 N·m	19 lb ft
Timing Chain Tensioner Bolt	10 N·m	89 lb in

Engine Cooling

Engine Cooling System Approximate Capacities

Application	Specifications	
	Metric	English
2.2 L Engine (RPO LN2)	9.1 L	9.6 qt
2.4 L Engine (RPO LD9)	9.4 L	9.9 qt

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Bleed Pipe Bolt	14 N·m	10 lb ft
Air Bleed Pipe Nut	42 N·m	31 lb ft
Cooling Fan Bolt	6 N·m	53 lb in
Coolant Inlet Housing Bolt-2.4L	14 N·m	10 lb ft

Coolant Inlet Housing Stud--2.4L	26 N·m	19 lb ft
Coolant Pipe Inlet Bolt	14 N·m	10 lb ft
Coolant Pipe Inlet Cover Bolt	14 N·m	10 lb ft
Coolant Pipe Inlet to Oil Pan	26 N·m	19 lb ft
Coolant Pump Bolt-2.2L	25 N·m	18 lb ft
Coolant Pump Cover Bolt--2.4L	14 N·m	10 lb ft
Coolant Pump Cover to Engine Block Bolt-2.4L	26 N·m	19 lb ft
Coolant Pump Pulley Bolt-2.2L	30 N·m	22 lb ft
Coolant Pump to Timing Chain Housing Nut-2.4L	26 N·m	19 lb ft
Coolant Outlet Bolt-2.2L	14 N·m	10 lb ft
Exhaust Manifold Heat Shield Bolt -2.4L	14 N·m	10 lb ft
Radiator Outlet Pipe Cover Bolt	14 N·m	10 lb ft
Radiator Outlet Pipe to Oil Pan Bolt	26 N·m	19 lb ft
Surge Tank Bolt	10 N·m	89 lb in
Transmission Oil Cooler Line Fitting	36 N·m	27 lb ft
Upper Radiator Mount Bolt	10 N·m	89 lb in

Cooling System Description and Operation

Coolant Heater

The optional engine coolant heater (RPO K05) operates using 110-volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Cooling System

The cooling system's function is to maintain an efficient engine operating temperature during all engine speeds and operating conditions. The cooling system is designed to remove approximately one-third of the heat produced by the burning of the air-fuel mixture. When the engine is cold, the coolant does not flow to the radiator until the thermostat opens. This allows the engine to warm quickly.

Cooling Cycle

Coolant flows from the radiator outlet and into the water pump inlet. Some coolant flows from the water pump, to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost capability as the coolant warms up.

Coolant also flows from the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

The coolant then flows through the cylinder head gasket openings and into the cylinder heads. In the cylinder heads, the coolant flows through the water jackets surrounding the combustion chambers and valve seats, where it absorbs additional heat.

From the cylinder heads, the coolant flows to the thermostat. The flow of coolant will either be stopped at the thermostat until the engine reaches normal operating temperature, or it will flow through the thermostat and into the radiator where it is cooled. At this point, the coolant flow cycle is completed.

Efficient operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components:

Coolant

The engine coolant is a solution made up of a 50-50 mixture of DEX-COOL and suitable drinking water. The coolant solution carries excess heat away from the engine to the radiator, where the heat is dissipated to the atmosphere.

Radiator

The radiator is a heat exchanger. It consists of a core and two tanks. The aluminum core is a tube and fin crossflow design that extends from the inlet tank to the outlet tank. Fins are placed around the outside of the tubes to improve heat transfer to the atmosphere.

The inlet and outlet tanks are a molded, high temperature, nylon reinforced plastic material. A high temperature rubber gasket seals the tank flange edge to the aluminum core. The tanks are clamped to the core with clinch tabs. The tabs are part of the aluminum header at each end of the core.

The radiator also has a drain cock located in the bottom of the left hand tank. The drain cock unit includes the drain cock and drain cock seal.

The radiator removes heat from the coolant passing through it. The fins on the core transfer heat from the coolant passing through the tubes. As air passes between the fins, it absorbs heat and cools the coolant.

Pressure Cap

The pressure cap seals the cooling system. It contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its seat by a spring, which protects the radiator from excessive cooling system pressure. The vacuum valve is held against its seat by a spring, which permits opening of the valve to relieve vacuum created in the cooling system as it cools off. The vacuum, if not relieved, might cause the radiator and/or coolant hoses to collapse.

The pressure cap allows cooling system pressure to build up as the temperature increases. As the pressure builds, the boiling point of the coolant increases. Engine coolant can be safely run at a temperature much higher than the boiling point of the coolant at atmospheric pressure. The hotter the coolant is, the faster the heat transfers from the radiator to the cooler, passing air.

The pressure in the cooling system can get too high. When the cooling system pressure exceeds the rating of the pressure cap, it raises the pressure valve, venting the excess pressure.

As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum causes the vacuum valve to open, allowing outside air into the surge tank. This equalizes the pressure in the cooling system with atmospheric pressure, preventing the radiator and coolant hoses from collapsing.

Coolant Recovery System

The coolant recovery system consists of a plastic coolant recovery reservoir and overflow tube. The recovery reservoir is also called a recovery tank or expansion tank. It is partially filled with coolant and is connected to the radiator fill neck with the overflow tube. Coolant can flow back and forth between the radiator and the reservoir.

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant, which has expanded due to being heated, is allowed to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions, no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates

almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Air Baffles and Seals

The cooling system uses deflectors, air baffles and air seals to increase cooling system capability. Deflectors are installed under the vehicle to redirect airflow beneath the vehicle and through the radiator to increase engine cooling. Air baffles are also used to direct airflow through the radiator and increase cooling capability. Air seals prevent air from bypassing the radiator and A/C condenser, and prevent recirculation of hot air for better hot weather cooling and A/C condenser performance.

Water Pump

The water pump is a centrifugal vane impeller type pump. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is mounted on the pump shaft and consists of a series of flat or curved blades or vanes on a flat plate. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force.

The impeller shaft is supported by one or more sealed bearings. The sealed bearings never need to be lubricated. Grease cannot leak out, dirt and water cannot get in as long as the seal is not damaged or worn.

The purpose of the water pump is to circulate coolant throughout the cooling system. The water pump is driven by the crankshaft via the drive belt.

Thermostat

The thermostat is a coolant flow control component. It's purpose is to help regulate the operating temperature of the engine. It utilizes a temperature sensitive wax-pellet element. The element connects to a valve through a small piston. When the element is heated, it expands and exerts pressure against the small piston. This pressure forces the valve to open. As the element is cooled, it contracts. This contraction allows a spring to push the valve closed.

When the coolant temperature is below the rated thermostat opening temperature, the thermostat valve remains closed. This prevents circulation of the coolant to the radiator and allows the engine to warm up. After the coolant temperature reaches the rated thermostat opening temperature, the thermostat valve will open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. The thermostat also provides a restriction in the cooling system, after it has opened. This restriction creates a pressure difference which prevents cavitation at the water pump and forces coolant to circulate through the engine block.

Engine Oil Cooler

The engine oil cooler is a heat exchanger. It is located inside the left side end tank of the radiator. The engine oil temperature is controlled by the temperature of the engine coolant that surrounds the oil cooler in the radiator.

The engine oil pump, pumps the oil through the engine oil cooler line to the oil cooler. The oil then flows through the cooler where the engine coolant absorbs heat from the oil. The oil is then pumped through the oil cooler return line, to the oil filter, to the engine block oil system.

Transmission Oil Cooler

The transmission oil cooler is a heat exchanger. It is located inside the right side end tank of the radiator. The transmission fluid temperature is regulated by the temperature of the engine coolant in the radiator.

The transmission oil pump, pumps the fluid through the transmission oil cooler line to the transmission oil cooler. The fluid then flows through the cooler where the engine coolant absorbs heat from the fluid. The fluid is then pumped through the transmission oil cooler return line, to the transmission.

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Negative Cable Terminal Bolt	15 N·m	11 lb ft
Battery Positive Cable Terminal Bolt	15 N·m	11 lb ft
Battery Side Terminal Adapter	15 N·m	11 lb ft
Generator Bolts 2.2L (L61)	17 N·m	13 lb ft
Generator Bolt-Lower 2.2L (LN2)	50 N·m	37 lb ft
Generator Bolt-Upper 2.2L (LN2)	30 N·m	22 lb ft
Generator Bolt 2.4L (LD9)	50 N·m	37 lb ft
Negative Battery Cable Ground Stud	25 N·m	18 lb ft
Positive Battery Cable to Starter Solenoid Nut	17 N·m	13 lb ft
Retainer Nut	18 N·m	13 lb ft
Starter Motor Bolts 2.2L (L61)	40 N·m	30 lb ft
Starter Motor Bolt 2.2L (LN2)	50 N·m	37 lb ft
Starter Motor Bolt 2.4L (LD9)	43 N·m	32 lb ft
Starter Motor Solenoid S Terminal Nut	3 N·m	27 lb in
Wire Harness Retainer Nut	18 N·m	13 lb ft

Battery Usage

Application	Specification
2.2L 4cyl (LN2, L61)	
GM Part Number	19001806
Cold Cranking Amperage (CCA)	525
Reserve Capacity	90 min.
Replacement Model Number	75-5YR
2.4L 4cyl (LD9)	
GM Part Number	19001807
Cold Cranking Amperage (CCA)	600
Reserve Capacity	90 min.
Replacement Model Number	75-6YR

Generator Usage

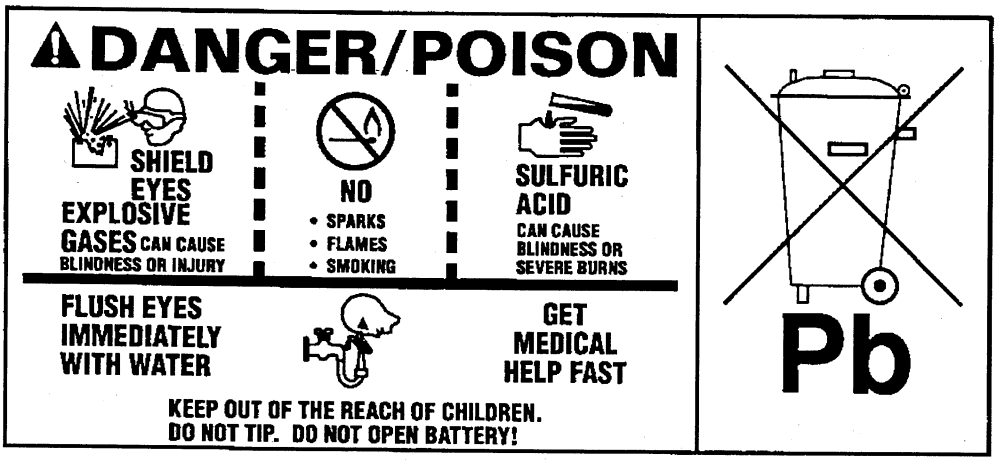
Application	Specification
LN2, LD9	
Generator Model	CS130D
Rated Output	105 A
Load Test Output	73 A

Battery Description and Operation

Caution

Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- **Always shield your eyes and avoid leaning over the battery whenever possible.**
- **Do not expose the battery to open flames or sparks.**
- **Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.**
- **Follow each step of the jump starting procedure in order.**
- **Treat both the booster and the discharged batteries carefully when using the jumper cables.**



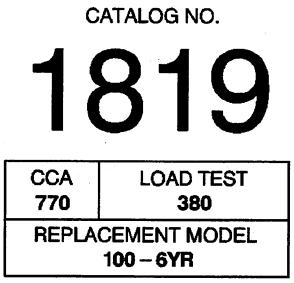
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

The battery has three functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload.

The battery specification label (example below) contains information about the following:

- The test ratings
- The original equipment catalog number
- The recommended replacement model number



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

When a battery is replaced use a battery with similar ratings. Refer to the battery specification label on the original battery or refer to Battery Usage .

Reserve Capacity

Reserve capacity is the amount of time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant temperature of 27°C (80°F) to reach a terminal voltage of 10.5 V. Refer to Battery Usage for the reserve capacity rating of the original equipment battery.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at -18°C (0°F) while maintaining at least 7.2 volts. Refer to Battery Usage for the cold cranking amperage rating for this vehicle.

Circuit Description

The battery positive terminal supplies Battery Positive voltage to the under hood fuse block and the rear fuse block. The under hood fuse block provides a cable connection for the generator and a cable connection for the starter.

The battery negative terminal is connected to chassis ground G305 and supplies ground for the AD converter in the DIM.

Starting System Description and Operation

The PG-260 F1 and PG-260L are non-repairable starter motors. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger

also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding because battery voltage is applied to both ends of the windings. The hold-in winding remains energized; its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, the START relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, causes the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Circuit Description

When the ignition switch is placed in the Start position 12 volts is supplied through the Park/Neutral Position Switch to the S terminal of the Starter Solenoid. Ground is found through the engine block.

Charging System Description and Operation

Generator

The generator features the following major components:

- The delta stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A conventional pulley
- Dual internal fans
- The regulator

The pulley and the fan cool the slip ring and the frame.

The generator features permanently lubricated bearings. Service should only include tightening of mount components. Otherwise, replace the generator as a complete unit.

Regulator

The voltage regulator controls the rotor field current in order to limit the system voltage. When the field current is on, the regulator switches the current on and off at a rate of 400 cycles per second in order to perform the following functions:

- Radio noise control
- Obtain the correct average current needed for proper system voltage control

At high speeds, the on-time may be 10 percent with the off-time at 90 percent. At low speeds, the on-time may be 90 percent and the off-time 10 percent.

Circuit Description

The generator provides voltage to operate the vehicle's electrical system and to charge its battery. A magnetic field is created when current flows through the rotor. This field rotates as the rotor is driven by

the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the battery terminal.

When the engine is running, the generator turn-on signal is sent to the generator from the PCM, turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation. The generator F terminal is connected internally to the voltage regulator and externally to the PCM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the PCM that a problem exists. The PCM monitors the generator field duty cycle signal circuit. The system voltage sense circuit receives battery positive voltage that is Hot At All Times through a fuse link that is connected to the starter motor. This voltage is used by the regulator as the reference for system voltage control.

Charging System Indicator

The IPC illuminates the charge indicator in the message center when the following occurs:

- The PCM detects that the generator output is less than 11 volts or greater than 16 volts. The IPC receives a class 2 message from the PCM requesting illumination.
- The IPC determines that the system voltage is less than 11 volts or greater than 16 volts. The IPC receives a class 2 message from the body control module (BCM) indicating the system voltage.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The ignition is on, with the engine off.

Engine Controls

Engine Controls - 2.2L (LN2)

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-3-4-2	
Spark Plug Wire Resistance	12,000 ohms per ft	
Spark Plug Torque	18 N·m	13 lb ft
Spark Plug Gap	1.016 mm	0.040 in
Spark Plug Type	41-948 [AC plug type]	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accel. Cable Bracket Bolts	10 N·m	89 lb in
Accel. Pedal Nuts	30 N·m	22 lb ft
Air Cleaner Outlet Duct Clamp	5 N·m	44 lb in
Air Cleaner Outlet Resonator Clamp	5 N·m	44 lb in
Air Cleaner Outlet Resonator Mounting Screws	10 N·m	89 lb in
Air Cleaner Resonator Bracket-Side Nut	10 N·m	89 lb in
Air Cleaner Resonator Bracket-Upper Nut	25 N·m	18 lb ft

Air Cleaner Resonator Bracket Bolt	25 N·m	18 lb ft
CKP Sensor Bolts	8 N·m	71 lb in
CMP Sensor Bolts	10 N·m	89 lb in
Engine Coolant Sensor	20 N·m	15 lb ft
Engine Oil Pressure Sensor	12 N·m	106 lb in
EVAP Canister Purge Valve Mounting Bracket Bolt	8 N·m	71 lb in
EVAP Canister Retainer Bolt	10 N·m	89 lb in
Exhaust Shield Bolt	2 N·m	18 lb in
Exhaust Shield Nuts	1 N·m	9 lb in
Flex Duct Clamps	5 N·m	44 lb in
Fuel Pipe Mounting Bolts	6 N·m	53 lb in
Fuel Filler Hose Clamp	3 N·m	27 lb in
Fuel Filter Fitting	27 N·m	20 lb ft
Fuel Pressure Regulator Attaching Screw	9.5 N·m	84 lb in
Fuel Rail Attaching Bolts	25 N·m	18 lb ft
Fuel Return Pipe to Fuel Pressure Regulator	33 N·m	24 lb ft
Fuel Tank Retaining Strap Bolts	35 N·m	26 lb ft
Headlamp Assembly Retaining Screws	7 N·m	61 lb in
Horn Attaching Bolt	10 N·m	89 lb in
HO2S 2	41 N·m	30 lb ft
ICM Screws	4 N·m	35 lb in
Idle Air Control Valve	3 N·m	27 lb in
Ignition Coil Screws	4 N·m	35 lb in
Knock Sensor	19 N·m	14 lb ft
Lower Air Cleaner Mounting Bolt	6 N·m	53 lb in
MAP Sensor Attaching Screw	6.5 N·m	53 lb in
O2S 1	41 N·m	30 lb ft
PCM Attaching Bolts	10 N·m	89 lb in
PCM Electrical Connector Screws	8 N·m	71 lb in
Resonator Attaching Bolt	7 N·m	61 lb in
Separator and Solenoid Attaching Bolts	8 N·m	71 lb in
Throttle Body Attaching Bolts	10 N·m	89 lb in
TP Sensor Mounting Screws	2 N·m	18 lb in
Upper Air Cleaner Cover Screws	3 N·m	27 lb in

Fuel System Specifications

Use regular unleaded gasoline rated at 87 octane or higher. It is recommended that the gasoline meet specifications which have been developed by the American Automobile Manufacturers Association (AAMA) and endorsed by the Canadian Motor Vehicle Manufacturers Association for better vehicle performance and engine protection. Gasoline meeting the AAMA specification could provide improved driveability and emission control system performance compared to other gasolines. For more information, write to: American Automobile Manufacturer's Association, 7430 Second Ave, Suite 300, Detroit MI 48202.

Be sure the posted octane is at least 87. If the octane is less than 87, you may get a heavy knocking noise when you drive. If the knocking is bad enough, the knocking can damage your engine.

If you are using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service. But do not worry if you hear a little pinging noise when you are accelerating or driving up a hill. That is normal, and you do not have to buy a higher octane fuel to get rid of the pinging. However, if there is a heavy, constant knock, that means you have a problem.

Notice

Your vehicle was not designed for fuel that contains methanol. Do not use methanol fuel which can corrode metal parts in your fuel system and also damage plastic and rubber parts. This kind of damage would not be covered under your warranty.

If your vehicle is certified to meet California Emission Standards, indicated on the under hood emission control label, your vehicle is designed to operate on fuels that meet California specifications. If such fuels are not available in states adopting California emissions standards, your vehicle will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be affected. The malfunction indicator lamp on your instrument panel may turn ON and/or your vehicle may fail a smog-check test. If this occurs, return to your authorized dealer for diagnosis to determine the cause of failure. In the event there is a determination that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

Some gasolines that are not reformulated for low emissions may contain an octane-enhancing additive called methylcyclopentadienyl manganese tricarbonyl (MMT). Ask your service station operator whether or not the fuel contains MMT.

Electronic Ignition (EI) System Description

System Operation

The electronic ignition (EI) system consists of the following:

- Two ignition coils
- The ignition control (IC) module
- The crankshaft position (CKP) sensor
- The camshaft position (CMP) sensor
- The powertrain control (PCM) module

In this system the secondary windings of each coil feed two spark plugs, and neither end of the windings are grounded. The engine cylinders are paired in opposites, i.e. cylinders 1 and 4, and 2 and 3. Each pair is on top dead center at the same time. When a coil discharges both plugs fire at the same time to complete a series circuit. The cylinder on the compression stroke is said to be the event cylinder, the cylinder on the exhaust stroke the waste cylinder. The waste cylinder requires very little of the available energy to fire the spark plug, the event cylinder will use most of the energy. This same process will be repeated when the respective pair of cylinders are on the opposite stroke. This method of ignition is known as waste spark ignition.

It is possible in a waste spark ignition system for a spark plug to fire even if the spark plug's companion plug is disconnected. The disconnected plug wire acts as one plate of a capacitor, with the engine being the other plate. These two capacitor plates are charged as the spark jumps across the gap of the connected spark plug. The plates are then discharged as the secondary energy is dissipated in an oscillating current across the gap of the spark plug that is still connected. Secondary voltage requirements are very high with part of the circuit open, but the ignition coil has enough reserve energy to fire the connected plug at idle. Under high load it is possible neither plug will fire resulting in a severe misfire. In order to properly control the ignition timing, the PCM relies on the following information:

- The engine load (manifold pressure or vacuum)
- The engine coolant temperature
- The intake air temperature
- The crankshaft position

- The engine speed (RPM)
- The knock sensor
- The TP sensor

System Components

The Crankshaft Position (CKP) Sensor

This system uses a magnetic CKP sensor, mounted remotely from the ICM, which protrudes into the block within approximately 0.050 inches from the crankshaft reluctor. The graphic illustrates a typical sensor in relationship to the crankshaft reluctor. The reluctor is a special wheel which is cast into the crankshaft with 7 slots machined into the wheel, 6 of which are equally spaced (60 degrees apart). A seventh slot is spaced 10 degrees from one of the other slots and serves to generate sync-pules. As the reluctor rotates as part of the crankshaft, the slots change the magnetic field of the sensor, creating an induced voltage pulse. This signal is known as the 7x or low resolution signal because it occurs 7 times per crankshaft resolution. The PCM uses this signal to determine the speed and position of the crankshaft. The 7x reference signal is also used for fuel injector activation and ignition coil sequencing.

Ignition Coils

Two separate coils are mounted to the ignition coil assembly. Each coil provides the spark for two plugs simultaneously (waste spark distribution). Each coil can also be replaced separately.

Ignition Control Module (ICM)

The ICM receives the ignition control (IC) signals from the powertrain control module (PCM) which in turn triggers the corresponding ignition coils. Since the PCM controls spark timing and ignition control during crank and run, there is no bypass mode. The ICM is not repairable. When an ICM is replaced, transfer the remaining components to the new module.

Air Intake System Description

The air induction system draws outside air through a forward mounted air cleaner. The air cleaner is remotely mounted. The air enters the engine by flowing in through the intake duct into the lower air cleaner, through the air filter, out of the upper air cleaner, through the flex duct, into the air cleaner outlet resonator, and into the throttle body and the intake manifold. The air is then directed into the intake runners, the cylinder head and into the cylinders. A remotely mounted resonator as well as a resonator mounted on the throttle body help to dampen the noise caused by drawing air into the engine.

Engine Controls - 2.4L (LN9)

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-3-4-2	
Spark Plug Torque	18 N·m	13 lb ft
Spark Plug Gap	1.27 mm	0.050 in
Spark Plug Type	41-963 [AC plug type]	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Bracket Bolts	10 N·m	89 lb in
Accelerator Pedal Nuts	30 N·m	25 lb ft
Air Cleaner Outlet Duct Clamps	5 N·m	44 lb in
Air Cleaner Outlet Resonator Clamp	5 N·m	44 lb in
Air Cleaner Outlet Resonator Mounting Screws	10 N·m	89 lb in
CKP Sensor Bolts	10 N·m	89 lb in
CMP Sensor Bolts	15 N·m	11 lb ft
Engine Coolant Sensor	20 N·m	15 lb ft
EVAP Canister Purge Valve Mounting Bracket Nut	8 N·m	71 lb in
EVAP Canister Retainer Bolt	10 N·m	89 lb in
Exhaust Shield Bolt	2.0 N·m	18 lb in
Exhaust Shield Nut	1.0 N·m	9 lb in
Fuel Feed Pipe to Fuel Rail	33 N·m	24 lb ft
Fuel Filler Hose Clamp	3 N·m	27 lb in
Fuel Filter Fitting	27 N·m	20 lb ft
Fuel Pipe Mounting Bolts	6 N·m	53 lb in
Fuel Pipe Retainer Bolts	12 N·m	106 lb in
Fuel Pressure Regulator Attaching Screw	9.5 N·m	84 lb in
Fuel Rail Attaching Bolts	26 N·m	19 lb ft
Fuel Return Pipe Bracket Screw	9.5 N·m	84 lb in
Fuel Tank Retaining Strap Bolts	35 N·m	26 lb ft
Headlamp Assembly Retaining Screws	7 N·m	61 lb in
Horn Attaching Bolt	10 N·m	89 lb in
HO2S 2	41 N·m	30 lb ft
ICM Cover Bolts	22 N·m	16 lb ft
ICM Screws	4 N·m	35 lb in
Idle Air Control Valve	3 N·m	27 lb in
Ignition Coil Housing Screws	4 N·m	35 lb in
Knock Sensor	25 N·m	19 lb ft
Map Sensor Replacement	6.5 N·m	57 lb in

O2S 1	41 N·m	30 lb ft
PCM Attaching Bolts	10 N·m	89 lb in
PCM Electrical Connector Screws	8 N·m	71 lb in
Resonator Attaching Bolt	7 N·m	61 lb in
Throttle Body Attaching Bolts	10 N·m	89 lb in
TP Sensor Mounting Screws	2 N·m	18 lb in
Upper Air Cleaner Cover Screws	3 N·m	27 lb in

Fuel System Specifications

See Fuel System Specifications for 2.2L Engine above.

Electronic Ignition (EI) System Description

See Electronic Ignition (EI) System Description for 2.2L Engine above.

Air Intake System Description

See Air Intake System Description for 2.2L Engine above.

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Exhaust Manifold Heat Shield Bolt (2.4 L)	14 N·m	10 lb ft
Exhaust Manifold Nut	13 N·m	115 lb in
Exhaust Manifold Pipe Bolt	45 N·m	33 lb ft
Flex Decoupler to Exhaust Manifold Bolt (2.4 L)	35 N·m	26 lb ft
Heater Outlet Hose Nut (2.2 L)	25 N·m	18 lb ft
Intermediate Pipe Bolt	30 N·m	22 lb ft
Muffler Hanger Bolt	16 N·m	12 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

The exhaust system carries exhaust gases, treated by the catalytic converter, through a resonator, if applicable and into the exhaust muffler where exhaust noise is lessened.

In order to secure the exhaust pipe to the exhaust manifold, a flange and seal-joint coupling is utilized. The exhaust system may utilize a slip-joint coupling design with a clamp and a U-bolt or a flange connection with a gasket.

Exhaust hangers and rubber insulators help to support the weight of the exhaust pipe along with insulating any exhaust system vibration, rattle, or noise.

Exhaust hangers also space the exhaust system away from the underbody of the vehicle and allows the exhaust system to expand as the exhaust system warms up.

Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

- Exhaust manifold
- Exhaust pipes
- Catalytic converters
- Exhaust muffler
- Exhaust resonator, if equipped
- Exhaust tail pipe, if equipped
- Exhaust hangers
- Exhaust heat shields

Resonator

Some exhaust systems are equipped with a resonator. The resonator, located either before or after the muffler, allows the use of mufflers with less back pressure. Resonators are used when vehicle characteristics require specific exhaust tuning.

Catalytic Converter

The catalytic converter is an emission control device added to the engine exhaust system in order to reduce hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) pollutants from the exhaust gas.

The catalytic converter is comprised of a ceramic monolith substrate, supported in insulation and housed within a sheet metal shell. The substrate may be washcoated with 3 noble metals:

- Platium (Pt)
- Palladium (Pd)
- Rhodium (Rh)

The catalyst in the converter is not serviceable.

Muffler

The exhaust muffler reduces the noise levels of the engine exhaust by the use of tuning tubes. The tuning tubes create channels inside the exhaust muffler that lower the sound levels created by the combustion of the engine.

Transmission/Transaxle Description and Operation

Manual Transmission - M86/M94 Getrag

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Drain/Fill Plugs	38 N·m	28 lb ft
Intermediate Shaft Bolts	100 N·m	74 lb ft
Front Transmission Mount	75 N·m	55 lb ft
Rear Cover Bolts	25 N·m	18 lb ft
Rear Transmission Mount	75 N·m	55 lb ft
Reverse Switch	18 N·m	13 lb ft
Ring Gear	90 N·m	66 lb ft
Shaft Bolts	100 N·m	74 lb ft
Shifter Guide Bolts	25 N·m	18 lb ft
Shifter Mounting Bolts	25 N·m	18 lb ft
Speed Sensor Bolt	12 N·m	8 lb ft
Transmission Housing Bolts	25 N·m	18 lb ft

Lubrication Specifications

Application	Specification	
	Metric	English
DEXRON®III	1.7 liters	1.8 quarts

Shim Size Specifications

Shim Thickness	
Metric	English
0.5 mm	0.0197 in
0.55 mm	0.0217 in
0.6 mm	0.0236 in
0.65 mm	0.0256 in
0.7 mm	0.0276 in
0.75 mm	0.0295 in
0.8 mm	0.0315 in
0.85 mm	0.0335 in
0.9 mm	0.0354 in
0.95 mm	0.0374 in
1.00 mm	0.0394 in
1.05 mm	0.0413 in
1.1 mm	0.0433 in
1.15 mm	0.0453 in
1.2 mm	0.0473 in
1.25 mm	0.0493 in
1.3 mm	0.0512 in
1.35 mm	0.0531 in

Automatic Transmission Shift Lock Control Description and Operation

The automatic transmission shift lock control system is a safety device that prevents an inadvertent shift out of PARK when the engine is running. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consists of thew following components:

- The automatic transmission shift lock control solenoid
- The body control module (BCM)
- The powertrain control module (PCM)

With the ignition in the ON position, battery positive voltage is supplied to the automatic transmission shift lock control solenoid. The automatic transmission shift lock control solenoid receives a ground from the BCM. When the automatic transmission shift lock control solenoid is energized, the shift lever mechanically locked in the PARK position. When the driver presses the brake pedal the PCM sends a class 2 serial data message to the BCM. The BCM turns OFF the ground control circuit and this de-energizes the automatic transmission shift lock control solenoid. When the automatic transmission shift lock control solenoid is de-energized, the shift lever may be moved out of the PARK position. The BCM determines transaxle shift lever position through a class 2 serial data message from the PCM. The PCM receives inputs from the park/neutral position switch and determines shift lever position. When the BCM receives this information and determines that the shift lever is out of the PARK position, the automatic transmission shift lock control solenoid ground is opened.

Automatic Transaxle - 3T40

Fastener Tightening Specifications

Description of Usage	Ref No.*	Qty	Size	Specification	
				Metric	English
Case Cover to Case	62	4	M8x1.25x45	24 N·m	18 lb ft
Case Cover to Case	63	4	M8x1.25x55	24 N·m	18 lb ft
Case Cover to Case	61	1	M8x1.25x40	24 N·m	18 lb ft
Case Cover to Case	60	7	M8x1.25x25	24 N·m	18 lb ft
Case Cover to Case	64	2	M8x1.25x25	24 N·m	18 lb ft
Case Side Cover	--	--	--	20 N·m	15 lb ft
Case to Drive Sprocket Support	114	4	M8x1.25x24	24 N·m	18 lb ft
Control Valve Body Cover to Case	36	11	M8x1.25x16	11 N·m	8 lb ft
Converter Shield	--	--	--	10 N·m	18 lb ft
Cooler Connector to Case	17	2	1/4-18NPSF	38 N·m	28 lb ft
Cooler Pipes at Case	--	--	--	22 N·m	16 lb ft
Cooler Pipes at Radiator	--	--	--	27 N·m	20 lb ft
Flywheel to Torque Converter	--	--	--	62 N·m	46 lb ft
Intermediate Servo Cover to Case	141	4	M6x1.0x20	11 N·m	8 lb ft
Line Pressure Plug	405	1	1/8-27NPTF	11 N·m	8 lb ft
Manual Detent Spring Assembly to Case	418	1	M6x1.0x10	11 N·m	8 lb ft
Oil Feed Tube Bolts	--	--	--	14 N·m	124 lb in
Oil Pan to Case	36	16	M8x1.25x16	10 N·m	89 lb in
Oil Pressure Switch to Valve Body	338	1	1/8-27NPTF	11 N·m	8 lb ft
Park/Neutral Position Switch to Case	--	--	--	24 N·m	18 lb ft
Parking Lock Bracket to Case	712	2	M8x1.25x25	24 N·m	18 lb ft

Pipe Retainer to Case	142	2	M6x1.0x15	24 N·m	18 lb ft
Pressure Switch Assembly Bolts	--	--	--	12 N·m	106 lb in
Pump Cover to Case Cover	44	1	M8x1.25x130	24 N·m	18 lb ft
Pump Cover to Valve Cover	8	4	M6x1.0x25	11 N·m	8 lb ft
Pump Cover to Valve Body	41	3	M6x1.0x90	11 N·m	8 lb ft
Shift Lever to Transmission Nut	--	--	--	20 N·m	15 lb ft
Speed Sensor/Govenor Cover to Case	8	2	M6x1.0x25	11 N·m	97 lb in
TCC Solenoid Valve to Valve Body	334	1	M6x1.0x16	11 N·m	97 lb in
Thrid Clutch Pressure Switch to Valve Body	335	1	1/8-27NPTF	11 N·m	97 lb in
Transmission to Engine Mount Bolts	--	--	--	96 N·m	71 lb ft
TV Cable to Case	N/A	1	M6x1.0x16	9 N·m	80 lb in
Valve Body to Case	43	1	M8x1.25x85	24 N·m	18 lb ft
Valve Body to Case Cover	24	9	M6x1.0x45	11 N·m	8 lb ft
Valve Body to Case Cover	40	2	M6x1.0x65.0	11 N·m	8 lb ft
Valve Body to Driven Sprocket Support	42	1	M8x1.25x65	24 N·m	18 lb ft

Transmission General Specifications

Name	Hydra-matic 3T40
RPO Codes	MD9
Production Location	Ypsilanti, Michigan
Vehicle Platform (Engine/Transmission) Usage	J
Transmission Drive	Transverse Mounted Front Wheel Drive
Maximum Engine Torque	270 N·m (200 lb ft)
1st Gear Ratio	2.840:1
2nd Gear Ratio	1.600:1
3rd Gear Ratio	1.000:1
Reverse	2.067:1
Torque Converter Size (Diameter of Torque Converter Turbine)	245 mm
Pressure Taps	Line Pressure Governor Pressure
Transmission Fluid Type	DEXRON® III
Transmission Type: 3	Three Forward Gears
Transmission Type: T	Transverse Mount
Transmission Type: 40	Product Series
Position Quadrant	P, R, N, D, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry	65.7 kg (144 lbs)
Transmission Weight Wet	73.1 kg (161 lbs)
Maximum Trailer Towing Capacity	487 kg (1,000 lbs)
Maximum Gross Vehicle Weight (GVW)	2,318 kg (5,100 lbs)

Ratios		
Chain	Final Drive	Effective (Overall)
33/37	2.84	3.18
33/37	3.06	3.43
33/37	3.33	3.73
35/35	2.84	2.84
35/35	3.06	3.06
35/35	3.33	3.33
37/33	2.84	2.53
37/33	3.06	2.73
37/33	3.33	2.97

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Bottom Pan Removal	3.8 liters	4 quarts
Complete Overhaul	6.6 liters	7 quarts
Dry	8.5 liters	9 quarts
(measurements are approximate)		

Range Reference

Range	Park/ Neutral	Reverse	D			2		1
Gear	P-N	R	1st	2nd	3rd	1st	2nd	1st
Direct Clutch	--	Applied	--	--	Applied	--	--	--
Interm. Band	--	--	--	Applied	--	--	Applied	--
Forward Clutch	--	--	Applied	Applied	Applied	Applied	Applied	Applied
Lo-Reverse Clutch	--	Applied	--	--	--	--	--	Applied
Roller Clutch	--	--	Holding	--	--	*Holding	--	Holding
*May not be holding in Intermediate (D2), may stay in 2nd gear when vehicle is stopped.								

Shift Speed

Transmission Model	OAKC
Vehicle Series	J
Engine Displacement	2.2L
Engine RPO Code	LN2
Engine VIN Code	4
Overall Axle Ratio	3.18
Final Drive Ratio	2.84
Drive/Driven Sprocket Teeth	33/37

Minimum Throttle 1-2 Upshift	11 mph (18 km/h)
Wide Open Throttle 1-2 Upshift	41 mph (66 km/h)
Minimum Throttle 2-3 Upshift	21 mph (34 km/h)
Wide Open Throttle 2-3 Upshift	76 mph (122 km/h)
Minimum TCC Apply	35
N/V Ratio	40
Torque Converter K-Factor	203
Governor Pressure Switch	N/A
Second Gear Pressure Switch	N/A
Third Gear Pressure Switch	N.O.
Direct Clutch Type	5 plate
Transmission Vent Type	Elbow
Manual Valve Thermal Element	No

- N/A = Not Available
- N.O. = Normally Open
- N/V Ratio = Engine RPM to Vehicle Speed ratio in the third gear with TCC applied
- K-Factor = Torque converter numeric rating (combines stall speed and torque multiplication ratings)

Transmission General Description

The Hydra-Matic 3T40 transmission is a fully automatic unit for front wheel drive vehicles. The 3T40 provides three forward gear ranges and a reverse. Throttle opening controls the oil pressure and shift points.

You can operate the transmission in any one of the following six modes:

- P -- Park position prevents the vehicle from rolling either forward or backward. For safety reasons, use the parking brake in addition to the park position.
- R -- Reverse allows the vehicle to be operated in a rearward direction.
- N -- Neutral allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- D -- Drive position is used for normal driving conditions. Drive position provides three gear ratios plus a converter clutch operation. Downshifts are available for safe passing by depressing the accelerator.
- 2 -- Manual second provides acceleration and engine braking. You may select this range at any vehicle speed.
- 1 -- Manual Low provides maximum engine braking. You may select this range at any vehicle speed.

Transmission Component and System Description

The 3T40 transmission consists primarily of the following components:

- A four-element hydraulic torque converter
- A compound planetary gear set
- A dual sprocket and drive link assembly
- Three multiple disc clutches
- One roller clutch
- An intermediate band assembly
- A valve body assembly
- A vane type oil pump

The electronic components of this unit are as follows:

- A third clutch pressure switch
- Torque converter clutch solenoid
- Park/neutral position switch
- Vehicle speed sensor assembly

Automatic Transaxle - 4T40-E/4T45-E

Fastener Tightening Specifications Unit Repair

Application	Specification	
	Metric	English
Bottom Pan to Case -- M6 x 1.0 x 19.0 (Qty 12)	12 N·m	106 lb in
Case Cover	24 N·m	18 lb ft
Case Side Cover	20 N·m	15 lb ft
Channel Plate to Case -- M6 x 1.0 x 28.0 (Qty 6)	12 N·m	106 lb in
Channel Plate to Case -- M6 x 1.0 x 63.0 (Qty 2)	12 N·m	106 lb in
Channel Plate to Driven Sprocket Support -- M6 x 1.0 x 28.0 (Qty 2)	14 N·m	124 lb in
Clip, Wiring Harness -- M6 x 1.0 x 15.0 (Qty 1)	12 N·m	106 lb in
Converter Shield	10 N·m	18 lb ft
Cooler Pipes at Case	8 N·m	71 lb in
Cooler Pipes at Radiator	20-40 N·m	15-30 lb ft
Cover Assembly, Intermediate 4th Servo to Case -- M6 x 1.0 x 28.0 (Qty 3)	12 N·m	106 lb in
Cover, Lo/Reverse Servo to Case -- M6 x 1.0 x 28.0 (Qty 3)	12 N·m	106 lb in
Cover, Side to Case -- M8 x 1.25 x 28.0 (Qty 10)	20 N·m	15 lb ft
Cover, Side to Case (Stud) -- M8 x 1.25 x 28.0 (Qty 1)	20 N·m	15 lb ft
Flywheel to Torque Converter	62 N·m	46 lb ft
Oil Check Plug	14 N·m	124 lb in
Oil Feed Tube Bolts	14 N·m	124 lb in
Oil Pan to Case	10 N·m	89 lb in
Park/Neutral Position Switch to Case	24 N·m	18 lb ft
Plug, Pipe -- 1/8-27 NPTF (Qty 2)	12 N·m	106 lb in
Pressure Switch Assembly Bolts	12 N·m	106 lb in
Pump, Valve Body, Channel Plate to Case -- M6 x 1.0 x 103.0 (Qty 1)	12 N·m	106 lb in

Pump, Valve Body to Channel Plate -- M6 x 1.0 x 63.0 (Qty 1)	12 N·m	106 lb in
Pump, Valve Body to Channel Plate -- M6 x 1.0 x 90.0 (Qty 6)	12 N·m	106 lb in
Sensor, Input Speed -- M6 x 1.0 x 15.0 (Qty 1)	12 N·m	106 lb in
Sensor, Output Speed (Stud) -- M6 x 1.0 x 15.0 (Qty 1)	12 N·m	106 lb in
Shift Lever to Transmission Nut	20 N·m	15 lb ft
Spacer, Channel Plate to Driven Sprocket Support -- M6 x 1.0 x 70.0 (Qty 2)	14 N·m	124 lb in
Speed Sensor Housing to Case	11 N·m	97 lb in
Spring and Roller Assembly, Detent to Channel Plate -- M6 x 1.0 x 19.0 (Qty 1)	12 N·m	106 lb in
Support Assembly, Drive Sprocket to Case -- M6 x 1.0 x 17.2 (Qty 6)	12 N·m	106 lb in
TFP Switch, Valve Body, Channel Plate --M6 x 1.0 x 51.0 (Qty 3)	12 N·m	106 lb in
TFP Switch, Valve Body, Channel Plate -- M6 x 1.0 x 63.0 (Qty 1)	12 N·m	106 lb in
TFP Switch, Valve Body, Channel Plate to Case -- M6 x 1.0 x 90.0 (Qty 2)	12 N·m	106 lb in
Transmission to Engine Mount Bolts	90 N·m	66 lb ft
Tube Assembly, Transmission Oil to Case -- M6 x 1.0 x 19.0 (Qty 2)	12 N·m	106 lb in
Tube Assembly, Transmission Oil to Forward Clutch Support -- M6 x 1.0 x 19.0 (Qty 1)	12 N·m	106 lb in
Tube Assembly, Transmission Oil to Lo/Reverse Servo Cover -- M6 x 1.0 x 19.0 (Qty 1)	12 N·m	106 lb in
TV Cable to Case	9 N·m	80 lb in
Valve Body, Channel Plate to Case -- M6 x 1.0 x 90.0 (Qty 5)	12 N·m	106 lb in
Valve Body, Channel Plate to Case -- M6 x 1.0 x 103.0 (Qty 2)	12 N·m	106 lb in
Valve Body to Channel Plate -- M6 x 1.0 x 51.0 (Qty 5)	12 N·m	106 lb in

Transmission General Specifications

Name	Hydra-Matic® 4T40-E/4T45-E
RPO Codes	MN4 - 4T40-E MN5 - 4T45-E
Production Location	Windsor, Ontario, Canada
Vehicle Platform Engine/Transmission Usage	J, N
Transmission Drive	Transverse Mounted Front Wheel Drive
Maximum Engine Torque	4T40-E 270 N·m (200 lb ft) 4T45-E 290 N·m (215 lb ft)
Maximum Shift Speed	1-2 6,500 RPM 2-3 6,500 RPM 3-4 6,500 RPM
1st Gear Ratio	2.960:1
2nd Gear Ratio	1.626:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.681:1
Reverse	2.143:1
Torque Converter Size - Diameter of Torque Converter Turbine	245 mm

Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
Transmission Fluid Capacity - Approximate	Bottom Pan Removal: 6.5 L (6.9 qts) Complete Overhaul: 9.0 L (9.5 qts) Dry: 12.2 L (12.9 qts)
Transmission Type: 4	Four Forward Gears
Transmission Type: T	Transverse Mount
Transmission Type: 40	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Overdrive, 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry	4T40-E 74.7 kg (164 lbs) 4T45-E 75.1 kg (165.6 lbs)
Transmission Weight Wet	4T40-E 85.0 kg (187 lbs) 4T45-E 85.5 kg (188.5 lbs)
Maximum Trailer Towing Capacity	487 kg (1,000 lbs)
Maximum Gross Vehicle Weight (GVW)	1,826 kg (4,100 lbs)

Ratios		
Chain	Final Drive	Effective - Overall
32/38	3.29	3.91
32/38	3.05	3.63
35/35	3.29	3.29
35/35	3.05	3.42
33/37	3.29	3.69
33/37	3.05	3.42

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Bottom Pan Removal	6.5 liters	6.9 quarts
Complete Overhaul	9.0 liters	9.5 quarts
Dry	12.2 liters	12.9 quarts
Measurements are approximate.		

Range Reference

Range	Park/ Neutral	Reverse	D				3			2			1	
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	3rd**	1st	2nd***
1-2 Shift Solenoid	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF
2-3 Shift Solenoid	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
2nd Clutch	--	--	--	A	A*	A*	--	A	A*	--	A	A*	--	A
2nd Roller Clutch	--	--	--	H	O	--	--	H	O	--	H	O	--	H
Int./4th Band	--	--	--	--	--	A	--	--	--	--	A	--	--	A
Reverse Clutch	--	A	--	--	--	--	--	--	--	--	--	--	--	--
Coast Clutch	--	--	--	--	--	--	A	A	A	A	A	A	A	A
Input Sprag	--	--	H	H	H	O	H	H	H	H	H	H	H	H
Direct Clutch	--	--	--	--	A	A	--	--	A	--	--	A	--	--
Forward Clutch	--	--	A	A	A	A*	A	A	A	A	A	A	A	A
Lo/Rev Band	A	A	--	--	--	--	--	--	--	--	--	--	A	--
Lo Roller Clutch	--	--	H	O	O	O	H	O	O	H	O	O	H	O

- A = Applied
- H = Holding
- O = Overrunning
- ON = The solenoid is energized
- OFF = The solenoid is de-energized
- * = Applied with no load
- ** = Manual SECOND-THIRD gear is only available above approximately 100 km/h (62 mph)
- *** = Manual FIRST-SECOND gear is only available above approximately 60 km/h (37 mph)
- Manual FIRST-THIRD gear is also possible at high vehicle speed as a safety feature

Shift Speed

		1-2 Shift @ +/- 3 mph			2-3 Shift @ +/- 4 mph			3-4 Shift @ +/- 5 mph			Downshifts @ +/- 4 mph			TCC Apply 3rd Gear
% of TPS		10	25	50	10	25	50	10	25	50	4-3 Coast	3-2 Coast	2-1 Coast	10%
Model	Engine RPO													
WKR	LN2	9	14.5	21	18	25	39.5	39	45	67	30	11.5	6	26
WBR	LD9	9	15	28	17	29	51	34	51	79	30	11	8	22

Transmission General Description

The 4T40-E is a fully automatic front wheel drive electronically controlled transmission. The 4T40-E provides four forward ranges including overdrive and one reverse gear range. The PCM controls shift points by means of two shift solenoids. A vane type pump supplies the oil pressure. The PCM regulates oil pressure by means of the Pressure Control Solenoid (PCS).

You can operate the transmission in any one of the following seven modes:

- P -- Park position prevents the vehicle from rolling either forward or backward. For safety reasons, use the parking brake in addition to the park position.
- R -- Reverse allows the vehicle to be operated in a rearward direction.
- N -- Neutral allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- D -- Overdrive is used for all normal driving conditions. Overdrive provides four gear ratios plus a converter clutch operation. Depress the accelerator in order to downshift for safe passing.
- 3 -- Drive position is used for city traffic, hilly terrain, and trailer towing. Drive provides three gear ranges and prevents the transmission from operating in fourth gear. Depress the accelerator in order to downshift.
- 2 -- Manual Second provides two gear ratios under most operating conditions. Manual Second provides acceleration and engine braking. You may select this range at any vehicle speed, but you cannot downshift the transmission into Second gear until the vehicle speed drops below approximately 100 km/h (62 mph).
- 1 -- Manual Lo provides maximum engine braking. You may select this range at any vehicle speed, but you cannot downshift the transmission into First gear until the vehicle speed drops below approximately 60 km/h (37 mph).

Transmission Component and System Description

The mechanical components of this unit are as follows:

- A torque converter with a torque converter clutch (TCC)
- A drive link assembly
- Intermediate/4th and Lo/Reverse friction band assemblies
- Forward, Coast, 2nd, Reverse, and Direct multiple disc clutch assemblies
- Two planetary gear sets: Input and Reaction
- Two roller clutches - Lo and 2nd
- One sprag clutch
- One vane type oil pump
- One control valve assembly
- A final drive and differential assembly

The electrical components of this unit are as follows:

- Two shift solenoid valves, 1-2 and 2-3
- A torque converter clutch pulse width modulated (TCC PWM) solenoid valve
- A transmission pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- Two speed sensors: input and output speed sensor
- An automatic transmission fluid pressure (TFP) manual valve position switch assembly
- An automatic transmission wiring harness assembly
- A park/neutral position switch

Adapt Function

Transmission Adapt Function

The 4T40-E transmission uses a line pressure control system, which has the ability to continuously adapt the system's line pressure. This compensates for normal wear of the following parts:

- The clutch fiber plates
- The seals
- The springs

The PCM maintains the Upshift Adapt parameters for the transmission The PCM monitors the AT ISS sensor and the AT OSS during commanded shifts in order to determine if a shift is occurring too fast or too slow. The PCM adjusts the signal from the transmission pressure control solenoid in order to maintain a set shift feel.

Transmission adapts must be reset whenever the transmission is overhauled or replaced.

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Actuator Bleed Screw	2 N·m	18 lb in
Clutch Cover to Flywheel Bolt 2.2L (Vin 4)	20 N·m plus rotate 30 degrees	15 lb ft plus rotate 30 degrees
Clutch Cover to Flywheel Bolts 2.4L (Vin T)	20 N·m plus rotate 45 degrees	15 lb ft plus rotate 45 degrees
Clutch Master Cylinder and Clutch Pedal Bracket Nut	21 N·m	15 lb ft

Hydraulic Clutch Description

Clutch Spin Down Time

Check the clutch spin down time as follows:

1. Apply the parking brake. Block the vehicle wheels.
2. Shift the manual transmission into neutral.
3. Start the engine. Run the engine at idle speed.
4. Engage the clutch.
5. Disengage the clutch. Wait 9 seconds.
6. Shift the transmission into reverse.

Clutch Driving Members

The clutch driving members are two flat surfaces machined to a smooth finish. They are:

1. The rear face of the engine flywheel
2. The front face of the clutch pressure plate

Clutch Driven Members

The driven member is the clutch driven plate. The clutch driven plate has a splined hub. The splined hub slides lengthwise along the splines of the input shaft. The splined hub drives the input shaft through these same splines. The driving and driven members are held together with a spring pressure. This pressure is exerted by a diaphragm spring in the clutch pressure plate.

Hydraulic Clutch Fluid

Notice

Do not use mineral or paraffin-base oil in the clutch hydraulic system. These fluids may damage the rubber parts in the cylinders.

When refilling the system or adding fluid after service, use GM Delco Supreme No. 2 Brake Fluid, or equivalent that meets DOT 3 specifications.

Hydraulic Clutch Operating Members

The clutch system consists of the following components:

- A master cylinder with a reservoir
- A switch
- An concentric slave cylinder connected to hydraulic tubing
- Pressure Plate
- Clutch Cover
- Diaphragm Springs
- Release Bearing
- Clutch Disc
- Torsional Springs

With the depression of the clutch pedal, the clutch master cylinder becomes pressurized from the force of the push rod into the master cylinder. This forces hydraulic fluid into the tubing from the master cylinder to the concentric slave cylinder. The concentric slave cylinder then engages by pushing the releasing bearing into the diaphragm spring and release the clutch. A hole in the cowl panel accommodates the master cylinder. A quick connect coupling helps route the hydraulic tubing. the concentric slave cylinder is inside the transmission and on the input bearing retainer. The hydraulic control system can be replaced without having to gain access to the clutch system internal components , simply engage the quick connect coupling mounted through the transmission housing. No adjustments to the clutch system are necessary. as the clutch wears, the fluid level in the master cylinder reservoir changes to compensates for clear wear. A new system will have fluid in the reservoir. An electrical switch on the push rod has two functions: One function is a clutch interlock, ensuring the engine does not start unless the clutch pedal is engaged (positioned to the floor). The second function is to cut off the cruise-control system (if so equipped) when the clutch pedal is engaged.

Abbreviations and Meanings

Abbreviation	Meaning
A	
A	Ampere(s)
ABS	Antilock Brake System
A/C	Air Conditioning
AC	Alternating Current
ACC	Accessory, Automatic Climate Control
ACL	Air Cleaner
ACR4	Air Conditioning Refrigerant, Recovery, Recycling, Recharging
AD	Automatic Disconnect
A/D	Analog to Digital
ADL	Automatic Door Lock
A/F	Air/Fuel Ratio
AH	Active Handling
AIR	Secondary Air Injection
ALC	Automatic Level Control, Automatic Lamp Control
AM/FM	Amplitude Modulation/Frequency Modulation
Ant	Antenna
AP	Accelerator Pedal
APCM	Accessory Power Control Module
API	American Petroleum Institute
APP	Accelerator Pedal Position
APT	Adjustable Part Throttle
ASM	Assembly, Accelerator and Servo Control Module
ASR	Acceleration Slip Regulation
A/T	Automatic Transmission/Transaxle
ATC	Automatic Transfer Case, Automatic Temperature Control
ATDC	After Top Dead Center
ATSLC	Automatic Transmission Shift Lock Control
Auto	Automatic
avg	Average
A4WD	Automatic Four-Wheel Drive
AWG	American Wire Gage
B	
B+	Battery Positive Voltage
BARO	Barometric Pressure
BATT	Battery
BBV	Brake Booster Vacuum
BCA	Bias Control Assembly
BCM	Body Control Module

BHP	Brake Horsepower
BLK	Black
BLU	Blue
BP	Back Pressure
BPCM	Battery Pack Control Module
BPMV	Brake Pressure Modulator Valve
BPP	Brake Pedal Position
BRN	Brown
BTDC	Before Top Dead Center
BTM	Battery Thermal Module
BTSI	Brake Transmission Shift Interlock
Btu	British Thermal Units
C	
°C	Degrees Celsius
CAC	Charge Air Cooler
CAFE	Corporate Average Fuel Economy
Cal	Calibration
Cam	Camshaft
CARB	California Air Resources Board
CC	Coast Clutch
cm^3	Cubic Centimeters
CCM	Convenience Charge Module, Chassis Control Module
CCOT	Cycling Clutch Orifice Tube
CCP	Climate Control Panel
CD	Compact Disc
CE	Commutator End
CEAB	Cold Engine Air Bleed
CEMF	Counter Electromotive Force
CEX	Cabin Exchanger
cfm	Cubic Feet per Minute
cg	Center of Gravity
CID	Cubic Inch Displacement
CKP	Crankshaft Position
CKT	Circuit
C/Ltr	Cigar Lighter
CL	Closed Loop
CLS	Coolant Level Switch
CMC	Compressor Motor Controller
CMP	Camshaft Position
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide

Coax	Coaxial
COMM	Communication
Conn	Connector
CPA	Connector Position Assurance
CPP	Clutch Pedal Position
CPS	Central Power Supply
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CRTC	Cathode Ray Tube Controller
CS	Charging System
CSFI	Central Sequential Fuel Injection
CTP	Closed Throttle Position
cu ft	Cubic Foot/Feet
cu in	Cubic Inch/Inches
CV	Constant Velocity Joint
CVRSS	Continuously Variable Road Sensing Suspension
Cyl	Cylinder(s)
D	
DAB	Delayed Accessory Bus
dB	Decibels
dBA	Decibels on A-weighted Scale
DC	Direct Current, Duty Cycle
DCM	Door Control Module
DE	Drive End
DEC	Digital Electronic Controller
DERM	Diagnostic Energy Reserve Module
DI	Distributor Ignition
dia	Diameter
DIC	Driver Information Center
Diff	Differential
DIM	Dash Integration Module
DK	Dark
DLC	Data Link Connector
DMCM	Drive Motor Control Module
DMM	Digital Multimeter
DMSDS	Drive Motor Speed and Direction Sensor
DMU	Drive Motor Unit
DOHC	Dual Overhead Camshafts
DR, Drvr	Driver
DRL	Daytime Running Lamps
DTC	Diagnostic Trouble Code

E	
EBCM	Electronic Brake Control Module
EBTCM	Electronic Brake and Traction Control Module
EC	Electrical Center, Engine Control
ECC	Electronic Climate Control
ECI	Extended Compressor at Idle
ECL	Engine Coolant Level
ECM	Engine Control Module, Electronic Control Module
ECS	Emission Control System
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EEVIR	Evaporator Equalized Values in Receiver
EFE	Early Fuel Evaporation
EGR	Exhaust Gas Recirculation
EGR TVV	Exhaust Gas Recirculation Thermal Vacuum Valve
EHPS	Electro-Hydraulic Power Steering
EI	Electronic Ignition
ELAP	Elapsed
ELC	Electronic Level Control
E/M	English/Metric
EMF	Electromotive Force
EMI	Electromagnetic Interference
Eng	Engine
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
EPR	Exhaust Pressure Regulator
EPROM	Erasable Programmable Read Only Memory
ESB	Expansion Spring Brake
ESC	Electronic Suspension Control
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
ETC	Electronic Throttle Control, Electronic Temperature Control, Electronic Timing Control
ETCC	Electronic Touch Climate Control
ETR	Electronically Tuned Receiver
ETS	Enhanced Traction System
EVAP	Evaporative Emission
EVO	Electronic Variable Orifice
Exh	Exhaust

F	
°F	Degrees Fahrenheit
FC	Fan Control
FDC	Fuel Data Center
FED	Federal All United States except California
FEDS	Fuel Enable Data Stream
FEX	Front Exchanger
FF	Flexible Fuel
FFH	Fuel-Fired Heater
FI	Fuel Injection
FMVSS	Federal U.S. Motor Vehicle Safety Standards
FP	Fuel Pump
ft	Foot/Feet
FT	Fuel Trim
F4WD	Full Time Four-Wheel Drive
4WAL	Four-Wheel Antilock
4WD	Four-Wheel Drive
FW	Flat Wire
FWD	Front Wheel Drive, Forward
G	
g	Grams, Gravitational Acceleration
GA	Gage, Gauge
gal	Gallon
gas	Gasoline
GCW	Gross Combination Weight
Gen	Generator
GL	Gear Lubricant
GM	General Motors
GM SPO	General Motors Service Parts Operations
gnd	Ground
gpm	Gallons per Minute
GRN	Green
GRY	Gray
GVWR	Gross Vehicle Weight Rating
H	
H	Hydrogen
H2O	Water
Harn	Harness
HC	Hydrocarbons
H/CMPR	High Compression

HD	Heavy Duty
HDC	Heavy Duty Cooling
hex	Hexagon, Hexadecimal
Hg	Mercury
Hi Alt	High Altitude
HO2S	Heated Oxygen Sensor
hp	Horsepower
HPL	High Pressure Liquid
HPS	High Performance System
HPV	High Pressure Vapor
HPVS	Heat Pump Ventilation System
Htd	Heated
HTR	Heater
HUD	Head-up Display
HVAC	Heater-Ventilation-Air Conditioning
HVACM	Heater-Vent-Air Conditioning Module
HVIL	High Voltage Interlock Loop
HVM	Heater Vent Module
Hz	Hertz
	I
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Integrated Circuit, Ignition Control
ICCS	Integrated Chassis Control System
ICM	Ignition Control Module
ID	Identification, Inside Diameter
IDI	Integrated Direct Ignition
IGBT	Insulated Gate Bi-Polar Transistor
ign	Ignition
ILC	Idle Load Compensator
in	Inch/Inches
INJ	Injection
inst	Instantaneous, Instant
IP	Instrument Panel
IPC	Instrument Panel Cluster
IPM	Instrument Panel Module
I/PEC	Instrument Panel Electrical Center
ISC	Idle Speed Control
ISO	International Standards Organization
ISS	Input Speed Shaft, Input Shaft Speed

K	
KAM	Keep Alive Memory
KDD	Keyboard Display Driver
kg	Kilogram
kHz	Kilohertz
km	Kilometer
km/h	Kilometers per Hour
km/l	Kilometers per Liter
kPa	Kilopascals
KS	Knock Sensor
kV	Kilovolts
L	
L	Liter
L4	Four Cylinder Engine, In-Line
L6	Six-Cylinder Engine, In-Line
lb	Pound
lb ft	Pound Feet Torque
lb in	Pound Inch Torque
LCD	Liquid Crystal Display
LDCL	Left Door Closed Locking
LDCM	Left Door Control Module
LDM	Lamp Driver Module
LED	Light Emitting Diode
LEV	Low Emissions Vehicle
LF	Left Front
lm	Lumens
LR	Left Rear
LT	Left
LT	Light
LT	Long Term
LTPI	Low Tire Pressure Indicator
LTPWS	Low Tire Pressure Warning System
M	
MAF	Mass Air Flow
Man	Manual
MAP	Manifold Absolute Pressure
MAT	Manifold Absolute Temperature
max	Maximum
M/C	Mixture Control
MDP	Manifold Differential Pressure

MFI	Multiport Fuel Injection
mi	Miles
MIL	Malfunction Indicator Lamp
min	Minimum
MIN	Mobile Identification Number
mL	Milliliter
mm	Millimeter
mpg	Miles per Gallon
mph	Miles per Hour
ms	Millisecond
MST	Manifold Surface Temperature
MSVA	Magnetic Steering Variable Assist, Magnasteer®
M/T	Manual Transmission/Transaxle
MV	Megavolt
mV	Millivolt
N	
NAES	North American Export Sales
NC	Normally Closed
NEG	Negative
Neu	Neutral
NI	Neutral Idle
NiMH	Nickel Metal Hydride
NLGI	National Lubricating Grease Institute
N·m	Newton-meter Torque
NO	Normally Open
NOx	Oxides of Nitrogen
NPTC	National Pipe Thread Coarse
NPTF	National Pipe Thread Fine
NOVRAM	Non-Volatile Random Access Memory
O	
O2	Oxygen
O2S	Oxygen Sensor
OBD	On-Board Diagnostics
OBD II	On-Board Diagnostics Second Generation
OC	Oxidation Converter Catalytic
OCS	Opportunity Charge Station
OD	Outside Diameter
ODM	Output Drive Module
ODO	Odometer
OE	Original Equipment
OEM	Original Equipment Manufacturer
OHC	Overhead Camshaft

ohms	Ohm
OL	Open Loop, Out of Limits
ORC	Oxidation Reduction Converter Catalytic
ORN	Orange
ORVR	On-Board Refueling Vapor Recovery
OSS	Output Shaft Speed
oz	Ounce(s)
P	
PAG	Polyalkylene Glycol
PAIR	Pulsed Secondary Air Injection
PASS, PSGR	Passenger
PASS-Key®	Personalized Automotive Security System
P/B	Power Brakes
PC	Pressure Control
PCB	Printed Circuit Board
PCM	Powertrain Control Module
PCS	Pressure Control Solenoid
PCV	Positive Crankcase Ventilation
PEB	Power Electronics Bay
PID	Parameter Identification
PIM	Power Inverter Module
PM	Permanent Magnet Generator
P/N	Part Number
PNK	Pink
PNP	Park/Neutral Position
PRNDL	Park, Reverse, Neutral, Drive, Low
POA	Pilot Operated Absolute Valve
POS	Positive, Position
POT	Potentiometer Variable Resistor
PPL	Purple
ppm	Parts per Million
PROM	Programmable Read Only Memory
P/S, PS	Power Steering
PSCM	Power Steering Control Module, Passenger Seat Control Module
PSD	Power Sliding Door
PSP	Power Steering Pressure
psi	Pounds per Square Inch
psia	Pounds per Square Inch Absolute
psig	Pounds per Square Inch Gauge
pt	Pint
PTC	Positive Temperature Coefficient
PWM	Pulse Width Modulated

Q	
QDM	Quad Driver Module
qt	Quart(s)
R	
R-12	Refrigerant-12
R-134a	Refrigerant-134a
RAM	Random Access Memory, Non-permanent memory device, memory contents are lost when power is removed.
RAP	Retained Accessory Power
RAV	Remote Activation Verification
RCDLR	Remote Control Door Lock Receiver
RDCM	Right Door Control Module
Ref	Reference
Rev	Reverse
REX	Rear Exchanger
RIM	Rear Integration Module
RF	Right Front, Radio Frequency
RFA	Remote Function Actuation
RFI	Radio Frequency Interference
RH	Right Hand
RKE	Remote Keyless Entry
Rly	Relay
ROM	Read Only Memory, Permanent memory device, memory contents are retained when power is removed.
RPM	Revolutions per Minute Engine Speed
RPO	Regular Production Option
RR	Right Rear
RSS	Road Sensing Suspension
RTD	Real Time Damping
RT	Right
RTV	Room Temperature Vulcanizing Sealer
RWAL	Rear Wheel Antilock
RWD	Rear Wheel Drive
S	
s	Second(s)
SAE	Society of Automotive Engineers
SC	Supercharger
SCB	Supercharger Bypass
SCM	Seat Control Module
SDM	Sensing and Diagnostic Module
SEO	Special Equipment Option
SFI	Sequential Multiport Fuel Injection

SI	System International Modern Version of Metric System
SIAB	Side Impact Air Bag
SIR	Supplemental Inflatable Restraint
SLA	Short/Long Arm Suspension
sol	Solenoid
SO2	Sulfur Dioxide
SP	Splice Pack
S/P	Series/Parallel
SPO	Service Parts Operations
SPS	Service Programming System, Speed Signal
sq ft, ft^2	Square Foot/Feet
sq in, in^2	Square Inch/Inches
SRC	Service Ride Control
SRI	Service Reminder Indicator
SRS	Supplemental Restraint System
SS	Shift Solenoid
ST	Scan Tool
STID	Station Identification Station ID
S4WD	Selectable Four-Wheel Drive
Sw	Switch
SWPS	Steering Wheel Position Sensor
syn	Synchronizer
T	
TAC	Throttle Actuator Control
Tach	Tachometer
TAP	Transmission Adaptive Pressure, Throttle Adaptive Pressure
TBI	Throttle Body Fuel Injection
TC	Turbocharger, Transmission Control
TCC	Torque Converter Clutch
TCS	Traction Control System
TDC	Top Dead Center
TEMP	Temperature
Term	Terminal
TFP	Transmission Fluid Pressure
TFT	Transmission Fluid Temperature
THM	Turbo Hydro-Matic
TIM	Tire Inflation Monitoring, Tire Inflation Module
TOC	Transmission Oil Cooler
TP	Throttle Position
TPA	Terminal Positive Assurance
TPM	Tire Pressure Monitoring, Tire Pressure Monitor
TR	Transmission Range

TRANS	Transmission/Transaxle
TT	Tell Tail Warning Lamp
TV	Throttle Valve
TVRS	Television and Radio Suppression
TVV	Thermal Vacuum Valve
TWC	Three Way Converter Catalytic
TWC+OC	Three Way + Oxidation Converter Catalytic
TXV	Thermal Expansion Valve
U	
UART	Universal Asynchronous Receiver Transmitter
U/H	Underhood
U/HEC	Underhood Electrical Center
U-joint	Universal Joint
UTD	Universal Theft Deterrent
UV	Ultraviolet
V	
V	Volt(s), Voltage
V6	Six-Cylinder Engine, V-Type
V8	Eight-Cylinder Engine, V-Type
Vac	Vacuum
VAC	Vehicle Access Code
VATS	Vehicle Anti-Theft System
VCIM	Vehicle Communication Interface Mode
VCM	Vehicle Control Module
V dif	Voltage Difference
VDOT	Variable Displacement Orifice Tube
VDV	Vacuum Delay Valve
vel	Velocity
VES	Variable Effort Steering
VF	Vacuum Fluorescent
VIO	Violet
VIN	Vehicle Identification Number
VLR	Voltage Loop Reserve
VMV	Vacuum Modulator Valve
VR	Voltage Regulator
V ref	Voltage Reference
VSES	Vehicle Stability Enhancement System
VSS	Vehicle Speed Sensor

W	
w/	With
W/B	Wheel Base
WHL	Wheel
WHT	White
w/o	Without
WOT	Wide Open Throttle
W/P	Water Pump
W/S	Windshield
WSS	Wheel Speed Sensor
WU-OC	Warm Up Oxidation Converter Catalytic
WU-TWC	Warm Up Three-Way Converter Catalytic
X	
X-valve	Expansion Valve
Y	
yd	Yard(s)
YEL	Yellow

Conversion - English/Metric

English	Multiply/ Divide by	Metric
In order to calculate English measurement, divide by the number in the center column. In order to calculate metric measurement, multiply by the number in the center column.		
Length		
in	25.4	mm
ft	0.3048	m
yd	0.9144	
mi	1.609	km
Area		
sq in	645.2	sq mm
	6.45	sq cm
sq ft	0.0929	sq m
sq yd	0.8361	
Volume		
cu in	16,387.00	cu mm
	16.387	cu cm
	0.0164	L
qt	0.9464	
gal	3.7854	
cu yd	0.764	cu m
Mass		
lb	0.4536	kg
ton	907.18	
	0.907	tonne (t)
Force		
Kg F	9.807	newtons (N)
oz F	0.278	
lb F	4.448	
Acceleration		
ft/s²	0.3048	m/s²
In/s²	0.0254	
Torque		
Lb in	0.11298	N·m
lb ft	1.3558	
Power		
hp	0.745	kW

Pressure (Stress)		
inches of H2O	0.2488	kPa
lb/sq in	6.895	
Energy (Work)		
Btu	1055	J (J= one Ws)
lb ft	1.3558	
kW hour	3,600,000.00	
Light		
Foot Candle	10.764	lm/m²
Velocity		
mph	1.6093	km/h
Temperature		
(°F - 32) 5/9	=	°C
°F	=	(9/5 °C + 32)
Fuel Performance		
235.215/mpg	=	100 km/L

Equivalents - Decimal and Metric

Fraction (in)	Decimal (in)	Metric (mm)
1/64	0.015625	0.39688
1/32	0.03125	0.79375
3/64	0.046875	1.19062
1/16	0.0625	1.5875
5/64	0.078125	1.98437
3/32	0.09375	2.38125
7/64	0.109375	2.77812
1/8	0.125	3.175
9/64	0.140625	3.57187
5/32	0.15625	3.96875
11/64	0.171875	4.36562
3/16	0.1875	4.7625
13/64	0.203125	5.15937
7/32	0.21875	5.55625
15/64	0.234375	5.95312
1/4	0.25	6.35
17/64	0.265625	6.74687
9/32	0.28125	7.14375
19/64	0.296875	7.54062
5/16	0.3125	7.9375
21/64	0.328125	8.33437
11/32	0.34375	8.73125
23/64	0.359375	9.12812
3/8	0.375	9.525
25/64	0.390625	9.92187
13/32	0.40625	10.31875
27/64	0.421875	10.71562
7/16	0.4375	11.1125
29/64	0.453125	11.50937
15/32	0.46875	11.90625
31/64	0.484375	12.30312
1/2	0.5	12.7
33/64	0.515625	13.09687
17/32	0.53125	13.49375
35/64	0.546875	13.89062
9/16	0.5625	14.2875
37/64	0.578125	14.68437
19/32	0.59375	15.08125
39/64	0.609375	15.47812

Fraction (in)	Decimal (in)	Metric (mm)
5/8	0.625	15.875
41/64	0.640625	16.27187
21/32	0.65625	16.66875
43/64	0.671875	17.06562
11/16	0.6875	17.4625
45/64	0.703125	17.85937
23/32	0.71875	18.25625
47/64	0.734375	18.65312
3/4	0.75	19.05
49/64	0.765625	19.44687
25/32	0.78125	19.84375
51/64	0.796875	20.24062
13/16	0.8125	20.6375
53/64	0.828125	21.03437
27/32	0.84375	21.43125
55/64	0.859375	21.82812
7/8	0.875	22.225
57/64	0.890625	22.62187
29/32	0.90625	23.01875
59/64	0.921875	23.41562
15/16	0.9375	23.8125
61/64	0.953125	24.20937
31/32	0.96875	24.60625
63/64	0.984375	25.00312
1	1.0	25.4

Fasteners

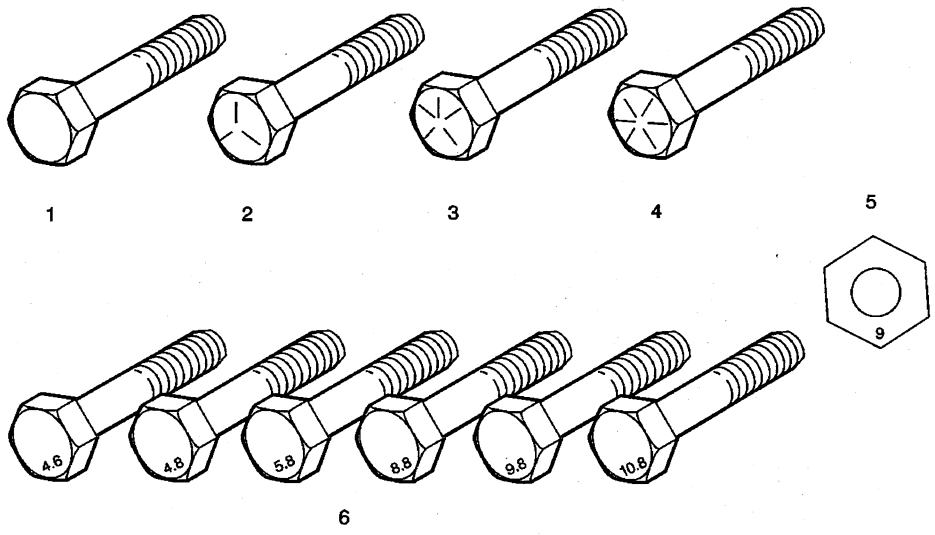
Metric Fasteners

This vehicle provides fastener dimensions using the metric system. Most metric fasteners are approximate in diameter to equivalent English fasteners. Make replacements using fasteners of the same nominal diameter, thread pitch, and strength.

A number marking identifies the OE metric fasteners except cross-recess head screws. The number also indicates the strength of the fastener material. A Posidrive® or Type 1A cross-recess identifies a metric cross-recess screw. For best results, use a Type 1A cross-recess screwdriver, or equivalent, in Posidrive® recess head screws.

GM Engineering Standards and North American Industries have adopted a portion of the ISO-defined standard metric fastener sizes. The purpose was to reduce the number of fastener sizes used while retaining the best thread qualities in each thread size. For example, the metric M6.0 X 1 screw, with nearly the same diameter and 25.4 threads per inch replaced the English 1/4-20 and 1/4-28 screws. The thread pitch is midway between the English coarse and fine thread pitches.

Fastener Strength Identification



1. English Bolt, Grade 2 (Strength Class)
2. English Bolt, Grade 5 (Strength Class)
3. English Bolt, Grade 7 (Strength Class)
4. English Bolt, Grade 8 (Strength Class)
5. Metric Nut, Strength Class 9
6. Metric Bolts, Strength Class Increases as Numbers Increase

The most commonly used metric fastener strength property classes are 9.8 and 10.9. The class identification is embossed on the head of each bolt. The English, inch strength classes range from grade 2 to grade 8. Radial lines are embossed on the head of each bolt in order to identify the strength class. The number of lines on the head of the bolt is 2 lines less than the actual grade. For example, a grade 8 bolt will have 6 radial lines on the bolt head. Some metric nuts are marked with a single digit strength identification number on the nut face.

The correct fasteners are available through GM SPO. Many metric fasteners available in the aftermarket parts channels are designed to metric standards of countries other than the United States, and may exhibit the following:

- Lower strength
- No numbered head marking system
- Wrong thread pitch

The metric fasteners on GM products are designed to new, international standards. The following are the common sizes and pitches, except for special applications:

- M6.0 X 1
- M8 X 1.25
- M10 X 1.5
- M12 X 1.75
- M14 X 2.00
- M16 X 2.00

Prevailing Torque Fasteners

Prevailing torque fasteners create a thread interface between the fastener and the fastener counterpart in order to prevent the fastener from loosening.

All Metal Prevailing Torque Fasteners

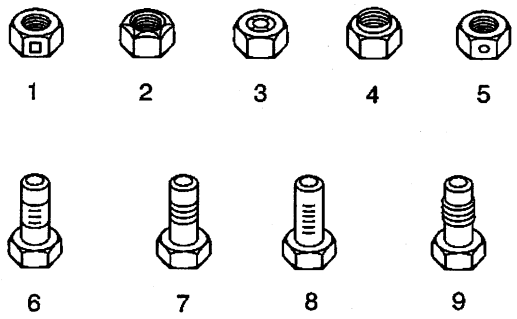
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

These fasteners accomplish the thread interface by the presence of a nylon material on the fastener threads.

Adhesive Coated Fasteners

These fasteners accomplish the thread interface by the presence of a thread-locking compound on the fastener threads. Refer to the appropriate repair procedure in order to determine if the fastener may be reused and the applicable thread-locking compound to apply to the fastener.



1. Prevailing Torque Nut, Center Lock Type
2. Prevailing Torque Nut, Top Lock Type

3. Prevailing Torque Nut, Nylon Patch Type
4. Prevailing Torque Nut, Nylon Washer Insert Type
5. Prevailing Torque Nut, Nylon Insert Type
6. Prevailing Torque Bolt, Dry Adhesive Coating Type
7. Prevailing Torque Bolt, Thread Profile Deformed Type
8. Prevailing Torque Bolt, Nylon Strip Type
9. Prevailing Torque Bolt, Out-of-Round Thread Area Type

A prevailing torque fastener may be reused ONLY if:

- The fastener and the fastener counterpart are clean and not damaged
- There is no rust on the fastener
- The fastener develops the specified minimum torque against its counterpart prior to the fastener seating

Metric Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
6 mm	0.4 N·m	4 lb in
8 mm	0.8 N·m	7 lb in
10 mm	1.4 N·m	12 lb in
12 mm	2.1 N·m	19 lb in
14 mm	3 N·m	27 lb in
16 mm	4.2 N·m	37 lb in
20 mm	7 N·m	62 lb in
24 mm	10.5 N·m	93 lb in
Nylon Interface Prevailing Torque Fasteners		
6 mm	0.3 N·m	3 lb in
8 mm	0.6 N·m	5 lb in
10 mm	1.1 N·m	10 lb in
12 mm	1.5 N·m	13 lb in
14 mm	2.3 N·m	20 lb in
16 mm	3.4 N·m	30 lb in
20 mm	5.5 N·m	49 lb in
24 mm	8.5 N·m	75 lb in

English Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
1/4 in	0.5 N·m	4.5 lb in
5/16 in	0.8 N·m	7.5 lb in
3/8 in	1.3 N·m	11.5 lb in
7/16 in	1.8 N·m	16 lb in
1/2 in	2.3 N·m	20 lb in
9/16 in	3.2 N·m	28 lb in
5/8 in	4 N·m	36 lb in
3/4 in	7 N·m	54 lb in
Nylon Interface Prevailing Torque Fasteners		
1/4 in	0.3 N·m	3 lb in
5/16 in	0.6 N·m	5 lb in
3/8 in	1 N·m	9 lb in
7/16 in	1.3 N·m	12 lb in
1/2 in	1.8 N·m	16 lb in
9/16 in	2.5 N·m	22 lb in
5/8 in	3.4 N·m	30 lb in
3/4 in	5 N·m	45 lb in